Kepler Cheuvreux TRANSITION RESEARCH

360 Report

Carbon Compass

23 November 2015

Investor guide to carbon footprinting

What's it all about?

Within the landscape of carbon metrics, it is sometimes difficult to find the right direction. We built this compass to guide you through current and developing carbon assessment tools: What can they tell you? What do they not tell you? What are the main methodological choices and how do they affect the end results? We explore and answer these questions in a simple and user-friendly way by looking at three types of metrics: carbon footprints, alternative and complementary measures (including green-brown share and 'avoided emissions') and static/forward-looking benchmarks. We also review the methodology of the main data providers on the market and detail the results of a series of workshops organised by the Institutional Investor Group on Climate Change (IIGCC).

In partnership with

IIGCC
Institutional Investors Group on Climate Change

2° Investing Initiative

Deloitte.

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Transition research team
Biographies at the end of the report

360 in 1 minute

Trending now

As more investors carry out a carbon footprint of their investments, encouraged by initiatives such as the Montreal Pledge and the Portfolio Decarbonisation Coalition, as well as growing regulatory pressure in certain countries like France, there are still a number of unresolved questions (see our ten burning questions).

Multiple metrics

There is growing consensus that carbon footprints are not enough and need to be complemented by other metrics that better reflect the forward-looking and multi-faceted nature of the climate change challenge. Carbon footprinting may be adequate to understand and communicate the contribution of investments to climate change, but other metrics are needed to: 1) understand the positive contribution of certain investments to the climate and energy transition as well as 2) the risk associated with certain investments in the medium to long run.

Focus on the use case

In turn, we explore carbon footprints, alternative and complementary metrics such as 'green-brown' share and 'avoided emissions', and benchmarks, both static and forward-looking. Which metric is the most appropriate? We argue that each has pros and cons and ultimately it depends on the aim of the analysis.

Ten burning questions

In this guide, we answer the main questions that our clients have been asking us on the topic of carbon and climate change metrics. Follow the link to access the answer directly!

Forewords

Eric Borremans, Vice Chair of IIGCC and Sustainability Expert at Pictet Asset Management

Investors have more reasons than ever to analyse their exposure to greenhouse gas emissions to gauge the likely impact of rising carbon prices, to identify the potential for stranded assets and to address growing demand for financing the transition to a low carbon economy. Consequently, for many investors a first step often involves portfolio carbon footprinting. For this reason, the IIGCC has worked closely with Kepler Cheuvreux to produce this excellent and timely report, published on the eve of the 2015 Paris Climate Summit.

Investors need robust and consistent metrics to mitigate the risks and seize the opportunities associated with climate change. It was this demand that inspired the series of carbon footprinting workshops organised over the past twelve months by the IIGCC across seven European cities. These workshops brought together leading service providers and hundreds of investors to test and debate the ways in which different methodologies can be used for communication, engagement and decision-making, but also to examine their strengths and limitations.

A summary of what was learned through this process forms a key case study at the heart of this report. It highlights how there is no such thing as a single aggregate carbon metric to capture the different aspects and impacts of climate risks. But what carbon footprinting can do is start a discussion between investors to inform the exposure of different investment strategies to the stock and the flow of greenhouse gas emissions.

Carbon metrics are no silver bullet. Investors also need sector and company-specific data to guide top-down and bottom-up investment decisions and to engage with companies which are laggards in their industry. 'Green' metrics are also required to measure how well a portfolio is exposed to the 'opportunity set' arising from the low-carbon economy. This report provides a solid foundation for investors to understand many different metrics and to assess their added value and limitations. Finally, this report also looks at the thorny question of data quality - still a key issue for companies which report incomplete or inaccurate data, and for investors who collectively need to exert pressure for better disclosure.

Carbon footprinting remains a work in progress, but we are confident that the emergence of a new set of metrics and calculation methodologies is a vital step for the implementation and credibility of climate change investment solutions.

The Institutional Investors Group on Climate Change is a European forum with over 115 members - including some of the largest pension funds and investment managers in Europe - who together represent over EUR12trn in assets. IIGCC provides investors with a common voice to encourage public policies that prevent dangerous climate change and enable the transition to a low carbon economy. IIGCC members also collaborate to develop better investment practices and to encourage corporate behaviour to address long-term risks and opportunities associated with climate change.

Two years ago, the Global Investor Coalition – of which IIGCC is a founding partner – produced *Climate Change Investment Solutions – A guide for Asset Owners* outlining a range of strategies investors can use to embed the impact of climate change in their investment policies and ownership practices, including low-carbon investments, reducing carbon exposure and increasing exposure to climate resilient assets.

Stan Dupre, Founder and Director 2° Investing Initiative

Recent momentum has shown that investors are increasingly concerned about climate change. Such concern stems from two distinct objectives: managing exposure to climate-related risks (physical, legal, and "carbon" or transition risk) and fulfilling their role as a capital provider in the transition to the low-carbon economy.

As explored in the Portfolio Carbon Initiative's recent report Climate Strategies and Metrics, the metrics investors should use to inform such objectives, and the specific approaches and communication strategies associated, should be as distinct as the objectives themselves. To date, portfolio carbon footprinting, reviewed in detail in this report, has been a great tool for educating the finance sector about its exposure to GHG emissions and raising general awareness. At the same time, as voluntary and mandatory disclosure regimes for both companies and investors move forward, it is becoming increasingly clear that footprinting alone will not fulfil investors' needs. More sophisticated metrics and methodologies are needed, specific to the use case of risk or contribution.

Crucially, this report moves the dialogue forward by reviewing not just the metrics that exist today, but looking forward at where investors may be tomorrow, coupling carbon metrics with exposure to green technologies and alignment with decarbonisation scenarios. It is refreshing to see a market leader like Kepler Cheuvreux involved in both areas—seizing the momentum and reviewing today's metrics while playing an integral part in the needed research to advance the state of the art.

Two European Commission projects coordinated by 2° Investing Initiative, the SEI Metrics consortium—studying alignment of investor portfolios to the energy transition--and the ET Risk consortium—studying the financial risks associated with the transition—will help move the ball forward. For example, as described in this report the SEI metrics project will deliver insight into how investor's portfolios are aligned or misaligned with the energy transition, and we encourage investors to contact us for a free and confidential 2° alignment check of any equity portfolio.

The 2° Investing Initiative is a multi-stakeholder think tank working to align the financial sector with 2°C climate goals. Our research and advocacy work seeks to:

- Align the investment processes of financial institutions with 2°C climate scenarios.
- Develop the metrics and tools to measure the climate performance of financial institutions.
- Mobilise regulatory and policy incentives to shift capital to energy transition financing.

The association was founded in 2012 in Paris and now has offices in New York, London, and Paris and research projects in Europe, China and the United States. Our work is global, both in terms of geography and engaging key players. We bring together financial institutions, issuers, policy makers, research institutes, experts, and NGOs to achieve our mission, and representatives from each stakeholder group sponsor our research.

Deloitte.

Florence Didier-Noaro and Julien Rivals, partners at Deloitte France

Despite the incredible progress made by companies and the development of reporting tools and standards in recent years, the challenge remains to get all major companies to report on their energy consumption and carbon emissions using similar standards and perimeters. Stakeholders acknowledge that an external assurance provides relevant evidence of the level of reliability of reported information.

Delivering assurance to GHG emissions according to international standards means that:

- the quantification methods and reporting policies selected and applied are consistent with the applicable criteria and are appropriate;
- estimates made in preparing the GHG statement are reasonable;
- the information presented in the GHG statement is relevant, reliable, complete, comparable and understandable;
- the GHG statement provides adequate disclosure of the applicable criteria, and other matters, including uncertainties, such that intended users can understand the important judgments made in its preparation; and
- the terminology used in the GHG statement is appropriate.

Basically, the concrete tasks to be performed by the auditor are the following:

1. assessing the suitability of the criteria, testing the consistency with the five principles: relevance, completeness, reliability, neutrality, understandability;
2. assessing the risks that the subject matter information may be materially misstated, by understanding the organisation, the process and the internal control;
3. performing further procedures clearly linked to the identified risks, using a combination of inspection, observation, confirmation, recalculation, reperformance, analytical procedures and inquiry.

Even if providing assurance to a portfolio carbon footprint might not be expected yet in all jurisdictions, applying assurance principles may lead asset managers and investors to implement more appropriate methodologies and tools. Audit culture and principles may help.

The contribution of Deloitte Conseil ("Deloitte") is solely limited to section "*the perspective of the verifier*" – pages 38 to 43 as Deloitte was requested by Kepler Cheuvreux to present the key concepts regarding assurance engagements and the main tasks performed by the verifier in that context.

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Carbon metrics: key dynamics

A growing number of investors are calculating and disclosing the carbon footprint of their portfolios, with a greater level of transparency on methodology shortcomings, data providers, and more interestingly, evolution over time. According to a 2015 Novethic survey, 94 investors have done a carbon footprint, and the number is increasing (+68% February - July 2015) (link).

What is driving these figures? This happens in a context where regulatory and stakeholder pressures are increasing, through initiatives like the Portfolio Decarbonisation Coalition, the Montreal Protocol, and the French law on Energy Transition driving action. The Investor Platform for Climate Action provides details on 17 initiatives undertaken by over 400 investors in 30 countries (link).

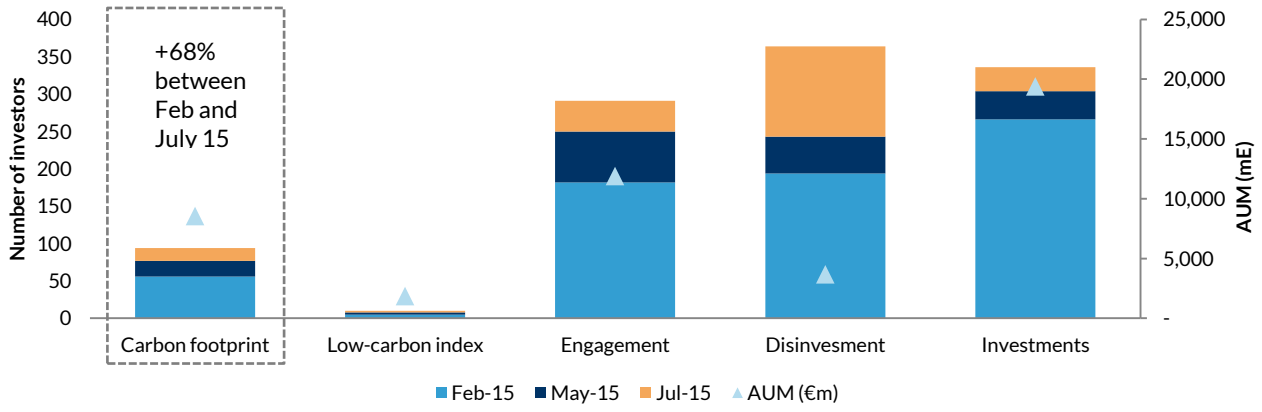
Three main dynamics....

We are observing three main dynamics in this field:

1. There is a growing recognition that additional metrics need to complement carbon footprints in order to help understand what is driving results, assess the positive contribution and alignment with transition scenarios, and in that perspective add a forward-looking element to the analysis.
2. The use case is an important determinant in choosing what metric is appropriate – 'climate-friendliness' and 'climate risks' are two separate objectives and different metrics are more suited for one or the other.
3. Carbon footprint results, as well as other carbon metrics, are not yet fully comparable due to different methodologies. This raises the question of standardisation.

In turn, we explore these in the introduction of this report.

Chart 1: An increasing number of investors have done a carbon footprint, alongside climate-related investment strategies



Source: Based on Novethic (2015)

Key dynamics no. 1: family portrait

New metrics and approaches are being developed by data providers, investors and other stakeholders to refine existing ones and shed light on new aspects of the climate change challenge. We attempt to map these methods on Chart 2, to show how they fit, or could theoretically fit together. We then detail each one in the next chapters, and focus on answering frequently-raised questions.

Portfolio carbon footprinting is usually the entry point of most investors in the world of carbon metrics…

- **Portfolio carbon footprinting is usually the entry point of most investors in the world of carbon metrics**. It either relies on data disclosed by the investee or on estimated data. Core methodological questions cover the inclusion of value chain data (beyond the operational or financial control of the investee) and double-counting. We explore these later. Most carbon footprints have been done on listed equity portfolios, but methodologies are now available for other asset classes, such as private equity, fixed income, real estate and even derivatives.

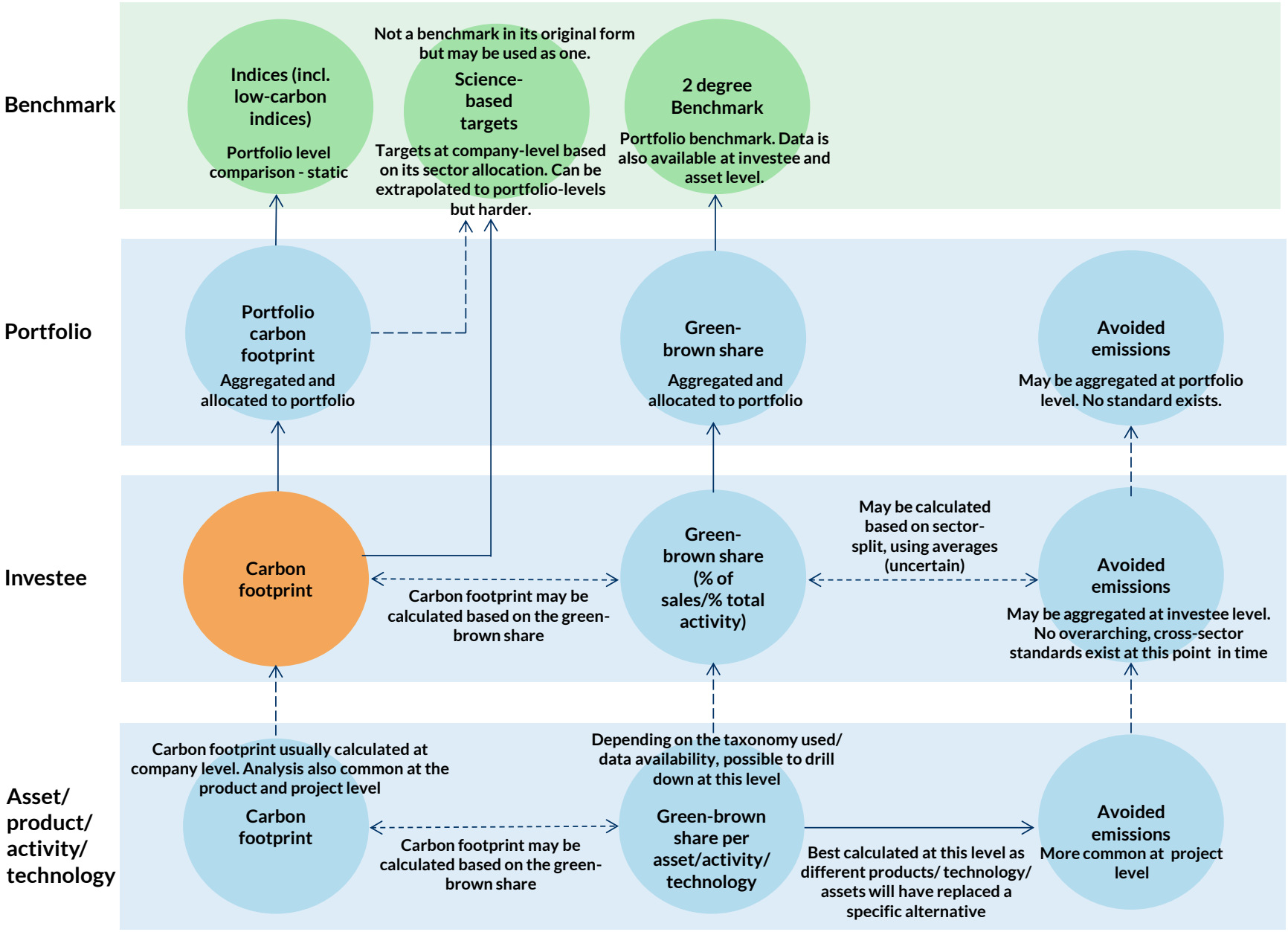
… sometimes complemented by green-brown metrics and measures of avoided emissions…

- Metrics calculating the proportion of the portfolio invested in 'green' and 'brown' sectors, companies, assets, products, activities or technologies are maturing. **These metrics are often used to complement or replace carbon footprints and get a sense of the dispersion of the climate challenge and opportunities within a portfolio**. It is worth noting that green-brown metrics can be used to estimate the carbon footprint of a portfolio or investee, even though this is not the traditional analysis pathway.
- **'Avoided emissions',** or emissions that were avoided outside of the scope of the investee due to its products or services, can be quantified using green-brown metrics at a product-level as a starting point (amongst other methodologies). These methods are mostly used in project finance, increasingly in the green bonds space, but no consensus exists yet on how to apply these to equity portfolios.
- **Green-brown metrics may also be forward-looking**, covering aspects such as fossil fuel reserves, planned capacity additions and retirements, and research & development in green products. This requires an all-new set of data in a context of increasing demand for this type of analysis, in particular supported by risk analysis such as the stream of work around stranded assets and the carbon bubble.

… which deliver their full meaning when compared to a relevant benchmark

- **Finally, some investors are interested in comparing the results with a benchmark to understand how their portfolios perform in relative terms.** We highlight three sets of benchmarks. The most widely used ones are market benchmarks, applying indexes such as MSCI ACWI. The comparison with these benchmarks can inform on the performance versus the status quo, but not a dynamic goal and pathway. A new set of benchmarks are being developed at company and portfolio level, which assess the alignment of a company and/or portfolio with a 2˚C world.

Chart 2: Our carbon metrics map



Source: Kepler Cheuvreux

Aren't we just overcomplicating everything?

This question often arises in conversations. Why not only include direct emissions, i.e. emissions generated directly by the activities of the investee versus indirect or supply chain emissions, as a carbon tax or emission trading scheme will most likely apply to these emissions? Similarly, can't an understanding of a portfolio's investment in 'green' and 'brown' technology indirectly inform on the exposure to climate change risks and opportunities?

Would you assess financial risk and performance with a single metric?

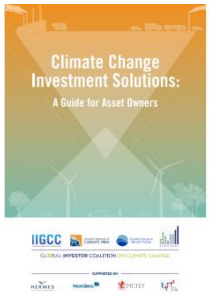
In answer to the first question, risk may be passed through the supply chain, depending on the pricing power of suppliers, hence creating a market risk in itself. In answer to the second, carbon footprint may be understood as a measure of the average climate responsibility of a portfolio where green-brown metrics may inform on the dispersion of potential risk and opportunities.

Just as there are several metrics used to assess the financial performance of an investment, the multifaceted nature of carbon and climate change should be captured through multiple metrics, each shedding light on a different aspect of the contribution and exposure to climate change.

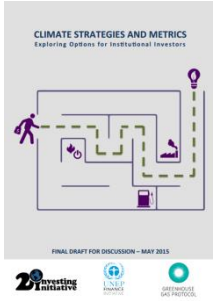
Key dynamics no. 2: increased focus on the objective

Investors should first define their investment belief and strategy and select appropriate metrics in that perspective, while ensuring that the methodological foundations are suitable to what they are trying to measure and accomplish. In short, the choice of metrics depends on what you are trying to achieve and how you will use them!

It depends on what you are trying to achieve!



The Institutional Investors Group on Climate Change (IIGCC) published a 'Guide for Asset Owners' (Climate Change Investment Solutions, link), which stresses the importance of conducting a 'strategic review' as a first step, in order to 'enable asset owners to better manage the risks and opportunities associated with climate change in a way that is consistent with the fiduciary duty to exercise due care, skill and diligence in the pursuit of the best interests of fund beneficiaries'.

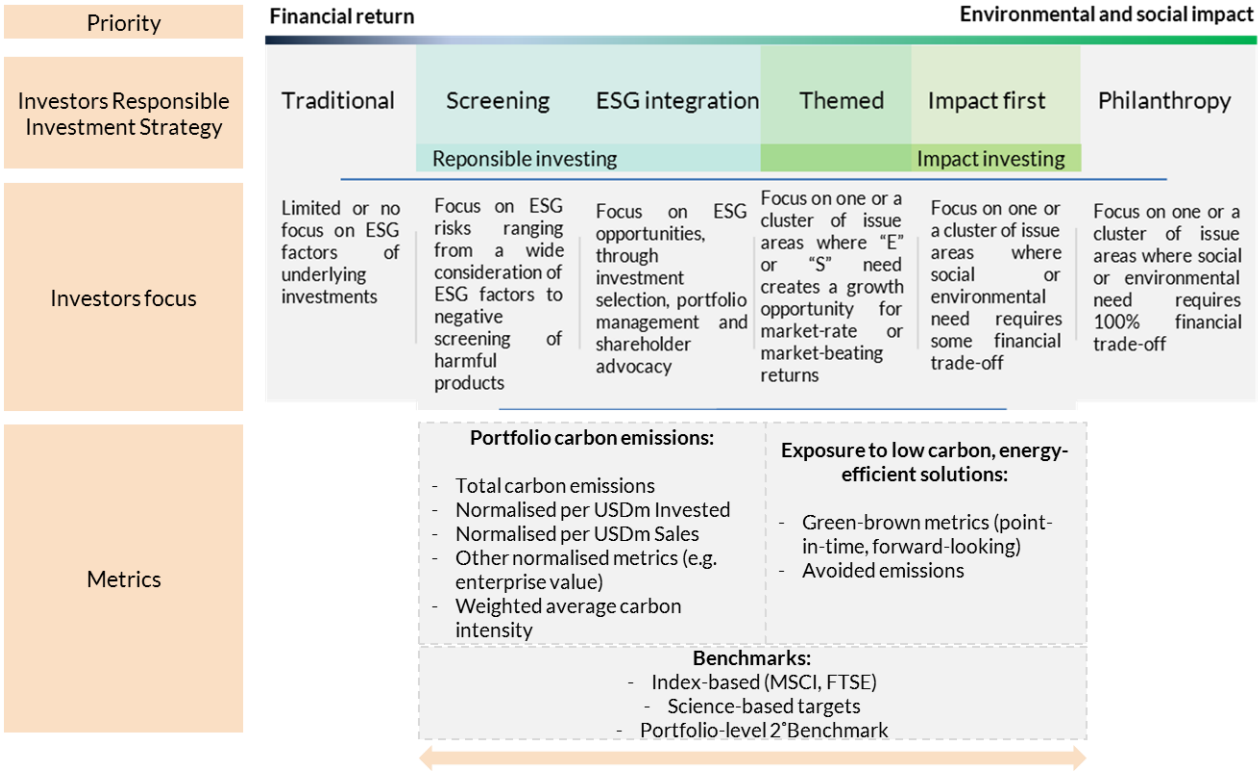


2°Investing Initiative, UNEP-FI and the Greenhouse Gas Protocol make the case for setting the objective of the analysis in order to choose the right metric (link): 'Investors should be clear about whether and how they are following a risk-driven strategy, a friendliness-driven strategy, or both'.

Negative versus positive contribution to climate change

Linking a portfolio with climate change may imply a wide range of investment strategies, spanning different combinations of sustainability impact and exposure to financial objectives, underpinned by a belief of how the world may look in the future. **We distinguish between strategies primarily focused on decreasing exposure through a minimised negative contribution to climate change, and others trying to leverage opportunities by investing in solution-oriented assets.**

Chart 3: Alignment between responsible investment strategies and reporting on climate change



Source: Kepler Cheuvreux (adapted from Bridges Ventures, Sonen Capital & KL Felicitas)

Note that in practice, this distinction between the search for risks, mitigation and opportunities on the one hand, and the right metrics on the other hand can be blurred in practice. For example:

- Rather than risk-reduction, a low-carbon investment approach may explicitly target opportunities for greater financial returns at companies that lead their peer group in terms of environmental performance management (e.g. across carbon-intensive sectors) or have a lower emissions profile than the index benchmark; these companies do not, however, necessarily have meaningful exposure to low-carbon solutions.
- Likewise, an investor focused on risk mitigation may seek an aggregated metric at portfolio level that is consequently the percentage of exposure to 'brown'/high-carbon intensity industries (e.g. coal). To give a full picture, reporting may in practice cover all these metrics, depending on the individual use and circumstances.

Throughout this guide, we assess each metric and approach based on what it can be used for, keeping the distinction between 'minimising negative contribution' versus 'maximising positive impact' in mind.

'Climate-friendliness' and risk

The two main investor initiatives that aim to take carbon foot printing to the next level (UNEP-FI and CDP "Portfolio Decarbonisation Coalition" (PDC) and the PRI "Montréal Carbon Pledge" (MCP)) entail a dual vision of "carbon footprinting": the PDC endorses an outcome-oriented approach targeting a critical mass of investors to incentivise global GHG emission reductions and investing in the green space, while the MCP's priority in our view appears to be more about understanding climate-related risk at investor level (with the aim of using this information to develop an engagement strategy and/or identify and set carbon footprint reduction targets) rather than proactively driving a climate impact.

"Investment impact" versus "impact on investment" in the context of carbon footprinting

The French government's 'energy transition for green growth' bill adopted this summer makes France the first country requiring asset owners and managers to measure their carbon footprint. It also embeds a mixed approach combining the "impact investing" mode with a fiduciary approach focused on climate risk "impact on investment". This dual approach highlights a fundamental difference: "investment impact" versus "impact on investment" and implies significant differences in metrics and reporting options.

We argue that even if carbon metrics can be used, under certain conditions, as a first (imperfect) step to analyse risk, they are primarily measures of 'climate-friendliness'. We detail under what circumstances carbon metrics can be used as a *first step* towards the analysis of risk in selected sections of this report.

Table 1: The four types of information investors must disclose under the French law – between risk and impact

Type of information	Law text	Qualitative or quantitative	Description and context
Investment policies	"Information on how their investment decision-making process takes social, environmental and governance criteria into consideration"	Qualitative	A description of the integration of climate (and other ESG) issues into investment decisions.
Financial risk exposure	"The exposure to climate-related risks"	Unclear	Exposure to financial risks associated with climate change, either physical or carbon asset risk
Associated GHG emissions	"Including the GHG emissions associated with assets owned"	Quantitative	Carbon footprint of the investor's portfolio or a relevant portion of the portfolio
Contribution to the energy transition (ET)	"The contribution to the international goal of limiting climate change and the contribution to the realisation of the energy and ecological transition. That contribution will be assessed with regards to indicative targets set by institutional investors taking into account the nature of their activities and investments, in a way that is consistent with the national low-carbon strategy"	Unclear	Degree to which investor's portfolio is aligned with both international (i.e. a 2° warming target) and French climate change policies

Source: 2° Investing Initiative (link)

Key dynamics no. 3: the route to standardisation

Compared to other Environmental, Social and Environmental indicators, Greenhouse gas (GHG) emissions is one of the most used and standardised. But it is not enough.

Already standardised... but it is not enough!

A better standardisation of metrics and reporting practices is highly desirable, and is associated with two main benefits:

- **It allows for a comparison of investors on content** – not only on their reporting practices – in order to facilitate the development of ratings, discrimination between financial products, and the introduction of public policy incentives.
- **It lowers the cost of implementation.** The capacity to innovate lies mostly with data providers. In the absence of a standard, asset managers have to evaluate each method requested by clients and buy the corresponding data as well as consolidate the metrics of each of their funds when asset management is delegated, leading to higher implementation costs.

We believe there are three potential layers of standardisation going forward:

- Commodity data, such as fossil fuel reserves and car production by type of technology, are already standardised to a certain extent, as covered by non-environmental standards.
- Data on what constitute a 'green' or high-carbon investment is more difficult to standardise. It may be driven by initiatives such as the Climate Bonds Initiative and index providers, but its application remains difficult in an equity context. There is no shared vision on the market at the moment.
- Carbon data at the investee level is already covered by the GHG Protocol, and notwithstanding some key limitations, can be considered quite comparable. It is more difficult when it comes to estimation techniques, where proprietary models from providers constitute a fundamental barrier to standardisation.

The GHG Protocol, UNEP-FI and 2° Investing Initiative are collaborating as part of the Portfolio Carbon Initiative in order to create a standard of reporting for asset owners on their GHG emissions and their contribution to the energy transition. Target publication is scheduled for end-2016.

Reader's guide

We first introduce our ten burning (and methodological) questions on the next page, to help access answers directly and easily.

The guide is segmented into three main parts, corresponding to the metrics on our 'carbon map':

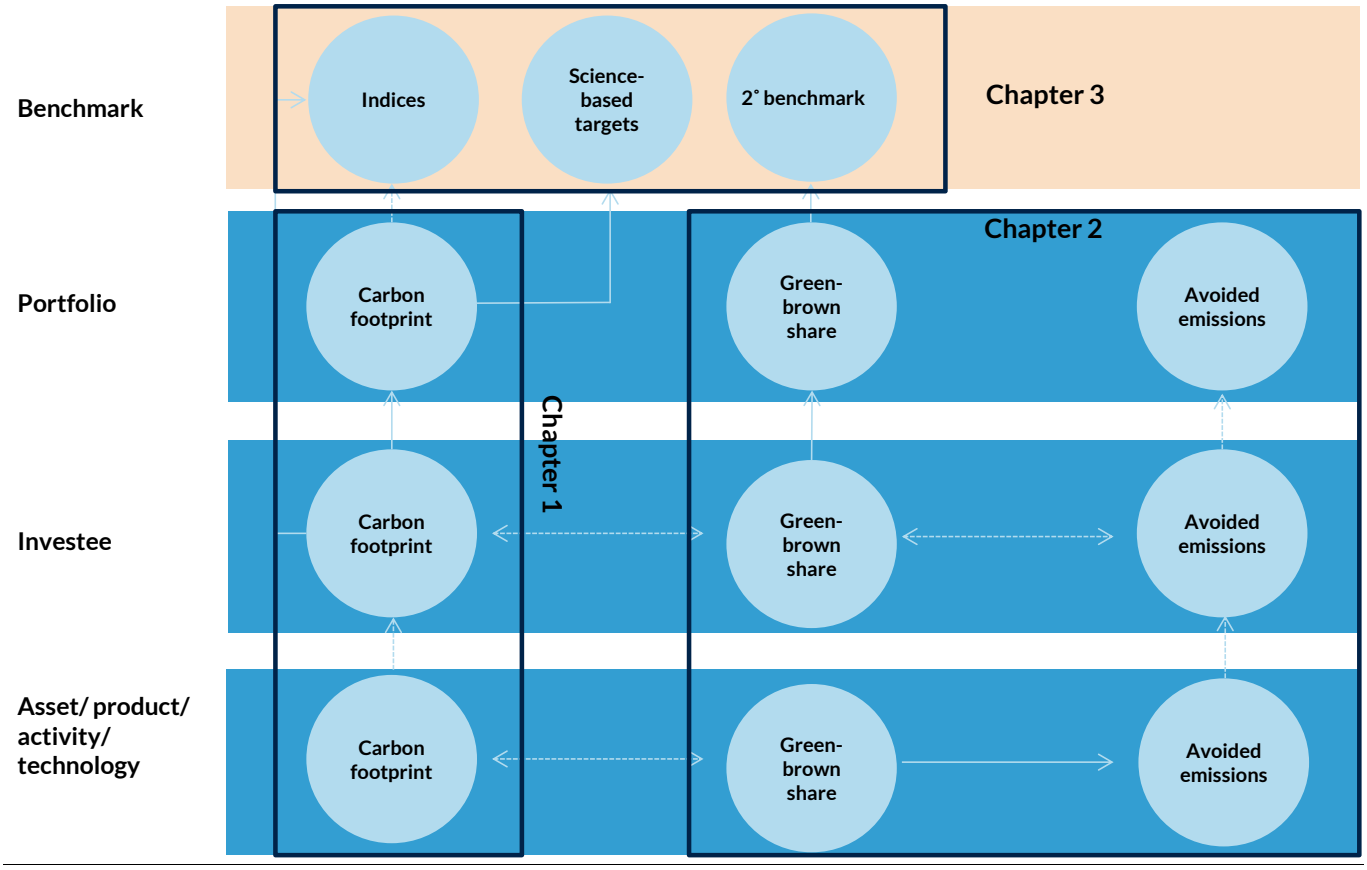
- Chapter 1: Carbon footprint
- Chapter 2: Complementary and alternative metrics
- Chapter 3: Benchmarking performance

We also include a fourth chapter that reviews the current market and methodology of data providers.

- Chapter 4: Data providers - reality check

Each part is split into two sections: 'If you only have five minutes' provides a summary of the section alongside more contextual information and a review of what the metric can be used for, and perhaps more importantly, what it cannot be used for. 'Fasten your seat belt' answers specific methodological questions that often come back on the subject.

Chart 4: Report structure



Source: Kepler Cheuvreux

Carbon footprint: the beginning of a journey

Efforts on reporting at portfolio level have overwhelmingly revolved around carbon footprinting on listed equity, as they benefit from:

1. **The broadest coverage among reporting companies, fuelled by progress made through several initiatives such as the CDP or the GHG Protocol.**
2. **The fact that it can be leveraged across responsible investment strategies, and for instance be perceived as an (imperfect) proxy to broader environmental risk management and the assessment of a portfolio contribution to climate change.**

Efforts on reporting at portfolio level have overwhelmingly revolved around carbon footprinting

If you only have five minutes

Mainly a measure of responsibility…

Carbon footprint is arguably the most widely-used, simple and high-level metric in this field. It can be understood as a measure of "**climate-friendliness", or contribution to climate change, still recognising a number of caveats that we explore in the following sections (e.g. inclusion of products and service emissions).**

…that might be used as a starting point to assess exposure to low-carbon transition risk...

Carbon intensity may be a starting point to assess exposure, in particular exposure to **carbon risks (e.g. regulatory risks) through investments in carbon-intensive assets**, depending on the choice of metric and if embedded into broader risk assessment frameworks *that take other factors into account*. Its relevance to inform exposure to **climate risk (e.g. physical risks from extreme weather events)** is however completely different as a carbon-intensive asset is not necessarily exposed to climate-related events such as drought or floods compared to a low-carbon one.

… and soon to become mandatory reporting

It is interesting to note the wording of the **French Law**. Point 2 requires investors to provide information on "Climate-related financial risks" (here understood as both carbon and climate risk) and point 3 calls for disclosing "*Associated* greenhouse gas emissions", thus leading to believe that carbon footprint is an integral component of risk assessment. The Montreal Pledge also takes this view.

While simpler metrics may "do the job"…

Carbon footprinting may not be necessary for a high-level, broad-based understanding of contribution and/or exposure. An assessment of the proportion invested in 'brown', or high-carbon sectors, could be sufficient for a simple estimation of the overall negative portfolio contribution to climate change.

… carbon footprinting is a widely-used measure at company level…

Companies have been reporting on their carbon footprint for a few years now, fuelled by reporting initiatives such as the CDP and the GHG Protocol. The next step is to transpose this concept at portfolio level by using the ownership logic. This transposition is relatively recent, with several still-unresolved technical questions.

… with many unresolved methodological questions

Questions include: should I include Scope 3? Should I care about double counting? What are the methods to estimate carbon data in the absence of reporting? How should I aggregate the data at portfolio level and what metrics should I use? What about the weighted average carbon intensity metric? We argue that there are no yes or no answers to these questions, as it depends on the use case, i.e. how the results will be used. We detail this in the next section.

It's just a start!

While imperfect, the results are useful to get a point-in-time picture of the portfolio contribution to climate change. A consensus is emerging on the fact that this metric needs to be used together with other methodologies, in order to develop a more holistic understanding of the underlying contribution but also exposure to risk. In particular, carbon footprint only measures the negative contribution of a portfolio to climate change, and ignores the potential positive contribution to the energy and climate change transition. Carbon footprints are also backward-looking.

A consensus is emerging on the fact that this metric needs to be used together with other methodologies, in order to develop a more holistic understanding of the underlying impact but also exposure to risk

What can you use it for?

Good for:

- Understanding and measuring the extent to which your portfolio contributes to climate change, at a high-level, at *time t*.
- Deep diving into the results to understand what sectors and investees contribute most to the footprint.
- Potentially communicating and complying with the French Law, depending on the application decree.

Not so good for:

- Managing climate change contribution and exposure: better used in conjunction with other metrics that take contextual information, trends and other dimensions into account.

Improvements needed:

- Better reporting, especially for private equity, small and medium companies and state-owned enterprises, to allow for a better understanding of the contribution to climate change.
- More systematic measures of uncertainty.
- Need for an accounting standard at portfolio level (it already exists at company level and is being developed at portfolio level by the GHG Protocol, UNEP-FI and 2° Investing Initiative).

Fasten your seatbelt

In this section, we answer the following questions:

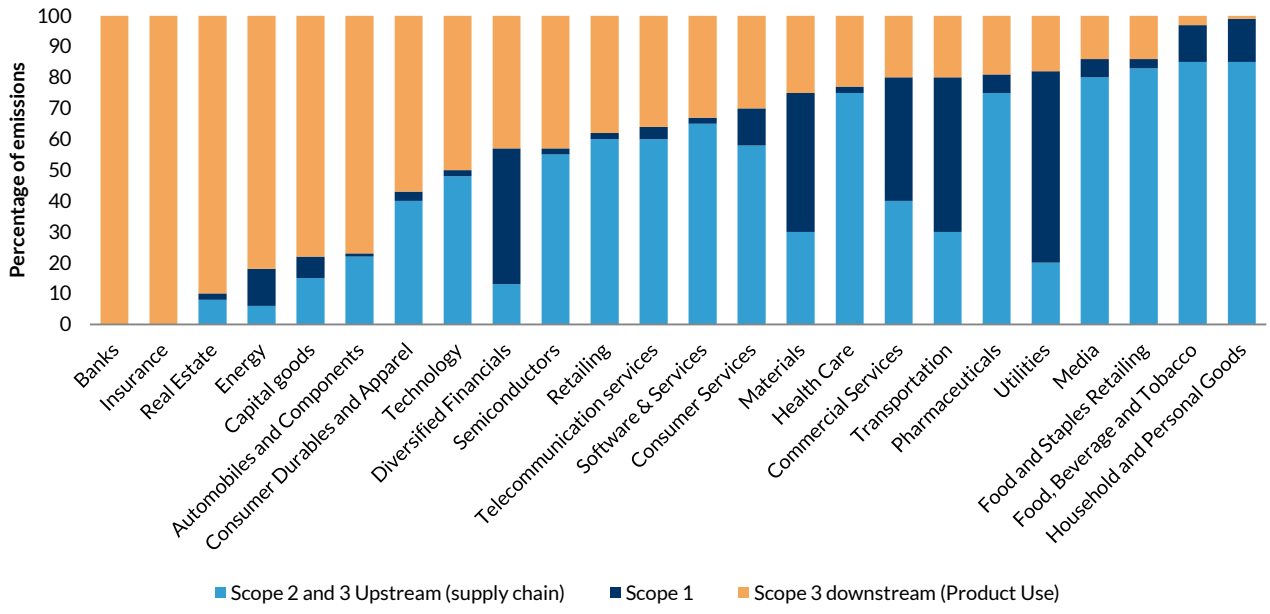
What scope should I include?

The GHG Protocol 'Corporate Accounting and Reporting Standard' (link) has developed a standard to measure the GHG emissions of **companies** using three 'scopes'.

- **Scope 1** emissions are the direct emissions of a company, notably from company vehicles and energy use in facilities.
- **Scope 2** emissions are indirect upstream emissions that come from the purchase of electricity, heating and cooling.
- **Scope 3** emissions are also indirect and refer to both upstream supply-chain emissions such as upstream logistics and purchased goods and services, as well as downstream activities, notably emissions from the use and disposal of sold products, as well as emissions from franchises. The GHG emissions from investments ('financed emissions') also fall into this category.

One could argue that a company has more influence on its Scope 1 and 2 emissions compared to its Scope 3 emissions. Note that this varies across Scope 3 categories (e.g. an automobile company has a large influence on the emissions of its cars).

Chart 5: Scope 3 – it matters!

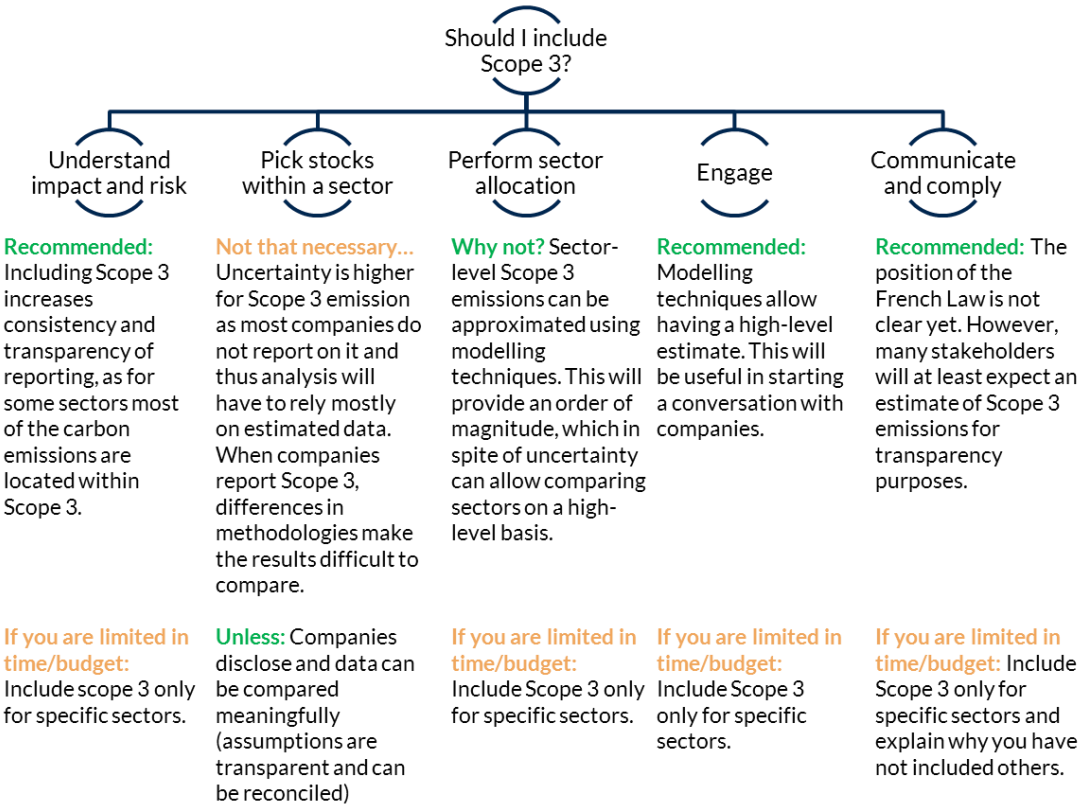


Source: Based on Inrate data

Yet, most companies do not disclose Scope 3 emissions, beyond categories such as 'business travel'. Only approximately 10 out of the world's 800 largest publicly-listed companies provide information on each of the 15 Scope 3 categories on a basis of 'comply-or-explain' (i.e. explanation is given as to why a Scope 3 category is not reported, usually because it is not relevant to the sector or business model) (link).

Most analyses include Scope 1 and Scope 2 emissions. Should you include Scope 3, and if so, which Scope 3 categories? There is a trade-off between coverage and uncertainty, as many companies do not report Scope 3, hence the need to use modelling techniques. We argue that overall, including Scope 3, while accepting that the quality may not be as high as Scope 1 and 2, gives a better (but still high-level and incomplete) picture of the climate change contribution and exposure profile of the portfolio, both for an internal and external audience.

Chart 6: Decision tree – should Scope 3 be included?



	Upstream Scope 3	Downstream Scope 3
Sectors for which Scope 3 is likely to be material	*Consumer goods, utilities, industrials, energy, materials, chemicals*	***Sold product*** *for oil and gas, automobiles, technology, apparel, chemicals* ***Financed emissions****: financials*

Source: Kepler Cheuvreux, 2° Investing Initiative, Inrate

What is the problem with double counting?

Double counting refers to cases where the same tonne of carbon is counted multiple times within a portfolio. It is a relevant question when individual company disclosures are aggregated at portfolio level, especially when Scope 2 and 3 emissions are included. According to Cross-asset footprint calculations, double-counting can reach about 30-40% of an institutional investor's portfolio emissions.

Expert track: when does double-counting occur?

There are several types of double-counting which occur as soon as Scope 2, and Scope 3 emissions are introduced. The variety of types and magnitude of emissions double counted increase with the comprehensiveness of approach in terms of Scopes and types of assets accounted. It can reach about 30-40% at the level of an institutional investors' portfolio, according to Cross-asset footprint calculations.

Double counting is a relevant question when individual company disclosures are aggregated at portfolio level, especially when Scope 2 and 3 emissions are included

Chart 7: How can double counting occur?

Category	Occurs when…	Example when company A and B are held in a portfolio
Electricity producer / user	Scope 2 is accounted	Company A produces the electricity (Scope 1) purchased by company B (Scope 2)
Supplier / user	Scope 3 is accounted	Company A uses the energy-consuming or GHG emitting goods (Scope 1) produced by company B (Scope 3)
Product / energy	Scope 3 is accounted	The petrol produced by company A (Scope 3) is burnt by the vehicles operated by (Scope 1) or produced by company B (Scope 3)
Product / component	Scope 3 is accounted	Company A sells engibes (product in use Scope 3) for the aircraft produced by comoany BN (Scope 3)
Producer / retailer	Scope 3 is accounted	Company A is a retailer (product in use Scope 3) of goods purchased by company B (Scope 3)
Owner / manager	Asset owners covered	The building operated by company A (Scope 1 under operational control) is owned by the real-estate trust B (Scope 1)
Lender / supplier	Lenders covered + Scope 3	The car sold by company A (Scope 3) has been purchased by a household, financed by a loan provided by the bank B
Issuer / underwriter	Underwriters covered	The bond unerwritten by bank Q is issued by co´mpany B

Source: 2° Investing Initiative

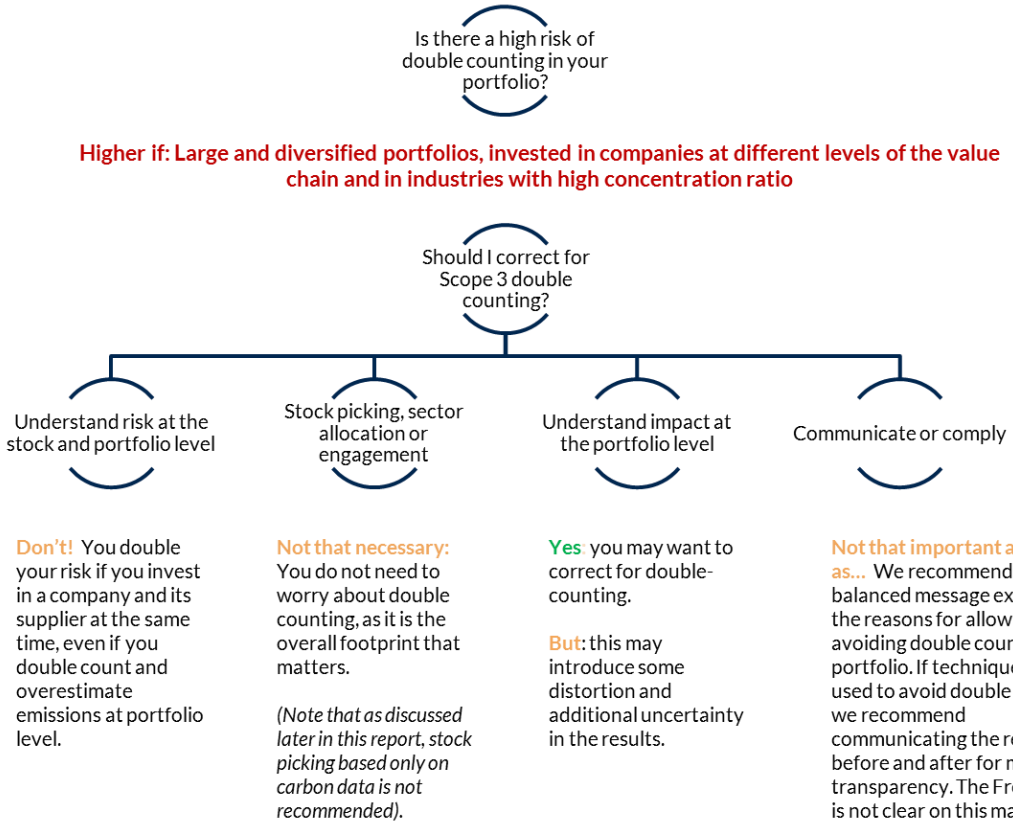
Is there a high risk of double counting occurring in your portfolio? Large and diversified portfolios, invested in companies at different levels of the value chain and in industries with a high concentration ratio, are more prone to double counting when including Scope 2 and 3 emissions.

For this reason, we believe double counting may not be that important, depending on what you are trying to achieve with your assessment

In practice it is very hard to identify specific supplier-customer relationships for each company in a portfolio. Eliminating double counting may lead to an over or underestimation of the footprint, as its premise is based on the fact that the portfolio is invested in both the buyer and supplier company.

For this reason, we believe it may not be that important depending on what you are trying to achieve with your assessment, as shown in Chart 8.

Chart 8: Decision tree – is double counting really a problem?



Source: Kepler Cheuvreux

We thus believe that in most cases, it is not necessary to avoid double-counting. If you still want to avoid double-counting, what are your options?

- **Limit your analysis to Scopes 1 and 2 and report each scope separately:** This minimises double counting in relation to Scope 3 but will not get rid of double counting between the company and its electricity provider. Most data providers and investors have chosen this approach so far.
- Several data providers have developed methodologies to avoid double counting, including - but not limited to - South Pole Group, Inrate, and Carbone 4. Bear in mind that this introduces distortion and increases uncertainty.
    - **On upstream Scope 3:** Carbone 4 and Mirova, in their Carbon Impact Analytics methodology, divide *total carbon figures* by three at a *portfolio level*, in order to eliminate double counting related to energy suppliers, energy and carbon-intensive companies and companies providing equipment and solutions. In practice, this is a simple but uncertain method, as the choice to divide by three has several limitations (e.g. it assumes that the emissions for each of the double counted companies are the same and that all three of the potentially double-counted companies are both listed companies and within the portfolio being analysed).

Limit your analysis to Scopes 1 and 2

Most data providers and investors have chosen this approach

- **On product-product, product-component:** We believe that the Carbone 4 and Mirova methodology is particularly interesting on the issue of double-counting between product/component: it uses value-add in order to allocate induced and avoided emissions between multiple components and an end-product. Value addition can be calculated at company or at a sector level.
- **On upstream Scope 3:** Methods developed by Inrate and South Pole Group involve identifying, within a given portfolio, all mutual exchanges between industries represented in the portfolio and the related double-counted emissions. This can only be done using an input-output model that tracks these exchanges on average (i.e. no specific supplier-purchaser relationships are utilized). Once the double-counted emissions are identified and quantified, they can be discounted from total gross emissions.

How do I aggregate the results at portfolio level?

The simplest carbon footprint measure is total carbon emissions, expressed in tonnes of carbon dioxide equivalent. It attributes the carbon emissions of the issuer to each equity investor based on its ownership, for example USD invested/market capitalisation or USD invested/debt outstanding.

The simplest carbon footprint measure is total carbon emissions, expressed in tonnes of carbon dioxide equivalent

Equation (1) $$\sum_{n}^{i} \frac{USD\ invested}{Ownership\ metric} * Issuer's\ emissions$$

This equation calculates the overall footprint of each portfolio and is useful to:

- **Compare with other absolute numbers**, for example to calculate the percentage contribution to the overall finance sector footprint.
- **Get a sense of the total contribution to climate change** that can be used for transparency purposes in communication or for mitigation strategies such as offsetting.
- **Understand sector and stock allocation effects**: Which sector or security contributes the most to the overall footprint?

The figure is absolute and not normalised, and will thus be reflective of the portfolio size rather than performance. It does not allow for comparison with different portfolios, a pre-determined benchmark, and/or through time, on a fair basis.

In our opinion, it is useful to decompose the formula between ownership of the company's sales and the carbon intensity per sales of the issuer to understand underlying differences in company efficiency

Expert track: a simple measure?

In our opinion, it is useful to **decompose** the formula between ownership of the investee's sales and the carbon intensity per sales of the investee to understand underlying differences in **company efficiency**.

Note that it will yield the same result as equation (1) but will allow for a better interpretation of the results. The formula could be modified as follow:

Equation (2) $$\sum_{n}^{i} \frac{\text{USD invested}}{Ownership\ metric} * \text{sales of issuer} * \frac{\text{Issuer's carbon emissions}}{\text{sales of issuer}}$$

Table 2: What can disaggregating sales tell you? An example with public equity

		USDm invested	Market capitalisation (USDm)	Carbon emissions (t C02e)	Sales (USDm))	Company efficiency (t/USDm)	Ownership	Carbon emissions attributed to the portfolio
Year 1	Company A	10	**30**	10,000	10	1,000	0.33	3,333
	Company B	1	**15**	30,000	3	10,000	0.07	2,000
							Total	5,333
Year 2	Company A	10	**30**	10,000	15	667	0.33	3,333
	Company B	1	**15**	30,000	4	7,500	0.07	2,000
							Total	5,333

Source: Kepler Cheuvreux

In this example, every variable is held constant. If sales figure were not disaggregated, one could think that nothing material happened between year 1 and year 2. When disaggregating for sales, the results are the same, but the improvement in both companies' carbon performance is clear – the carbon intensity, or t per USDm revenue, has decreased, showing a positive improvement in efficiency.

What metric should I use to normalise?

Normalising is essential to compare portfolios of different size and through time as it controls, to a certain extent, variations in other underlying metrics. Absolute carbon footprint can be normalised by the amount invested using the portfolio value or the portfolio claim on sales, for example. MSCI recently reviewed the existing methods – including the pros and cons of each of them (link).

Using the portfolio value as the normalising metric is easier to understand and more intuitive, and it's the metric that appears to be preferred by the industry. This shows the carbon footprint of your money.

Using the portfolio market value as the normalising metric is easier to understand and more intuitive and it's the metric that appears to be preferred by the industry

This shows the carbon footprint of your money

However, its simplicity may mask important differences at company level. Using portfolio claim on sales to normalise adds an additional layer of information that we recommend analysing.

- It maintains the ownership logic (through the concept of claim) but takes into account the carbon efficiency of the company. In particular, it corrects for the biases introduced by market cap and price-to-sales ratio.
- It corrects for the company's size. For example, a larger company tends to have a larger carbon footprint in total; so the same ownership percentage as in a smaller company with a lower footprint will yield a higher carbon metric when normalising by USD invested rather than claims on sales.

- Other normalising metrics could include EBIT, EBITDA, net assets, and other financial items. These do not seem to have been widely used so far.

Expert track: What drives the difference between GHG/USD invested and GHG/USD sales?

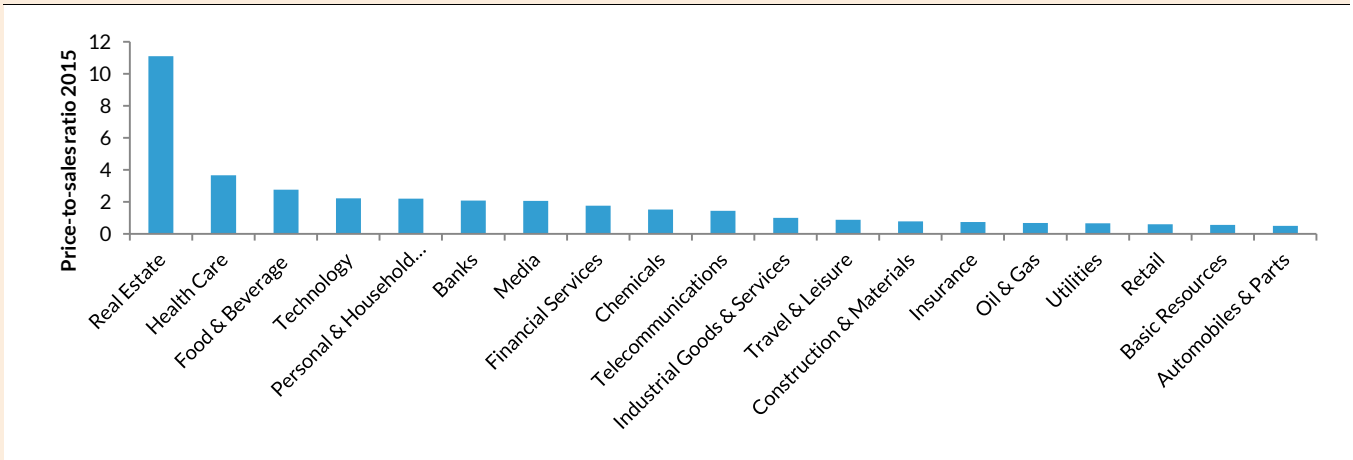
The difference between the metrics GHG/USDm invested and GHG/USDm sales, everything else held constant, lies in the difference between sales and market capitalisation.

(GHG/USD sales)/(GHG/USD market cap) = market cap/sales or price-to-sales ratio. A higher GHG/USD sales compared to GHG/USD market cap, everything else held constant, means that the average price-to-sales ratio is lower than 1.

- If price-sales ratio = 1, then GHG/USD sales = GHG/USD market cap
- If price-sales ratio >1, then GHG/USD sales > GHG/USD market cap
- If price-sales ratio<1, then GHG/USD sales <GHG/USD market cap

This applies at portfolio and company level. It thus follows that strategies built on GHG/USD market cap favours companies/sectors with the highest price-to-sales ratio, which will appear better compared to other sectors/peers.

Chart 9: Price-to-sales ratio per sector, 2015



Source: Based on STOXX Europe 600 da

Claim on sales is also an imperfect metric. Revenue may vary due to different pricing policies, either strategy (e.g. luxury industry), regulations (e.g. energy company in different markets) or simply exchange rates. Using sales data instead of physical metrics favours companies with a higher pricing level than their peers, leading to lower carbon intensity (per USDm sales). For example, a luxury car company may have a lower carbon intensity per USDm sales compared to a peer with lower prices, even if the carbon intensity per production unit is the same. By extension, this is true at a portfolio level.

Using sales data instead of physical metrics favours companies with higher pricing level/margins than their peers

By extension, this is true at portfolio level

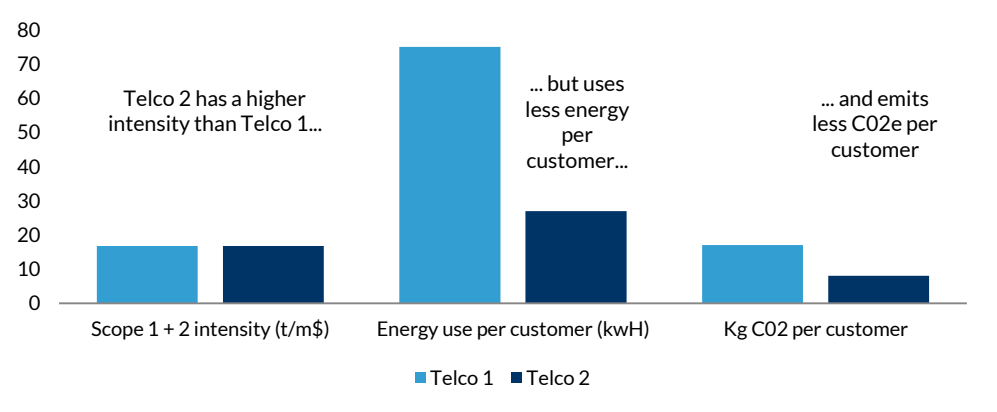
This question mirrors the debate between the use of life-cycle analysis metrics or environmentally-extended environmental input-output data in order to model data gaps at company level.

Sales metrics are only a proxy for performance and more sophisticated analysis may want to incorporate physical production data. This is not always possible.

- Few companies report physical production metrics that can be used. This is limited to certain sectors such as Tobacco, Beverages, Utilities, Construction, Telecommunications and Aviation. Even when reported, the metrics may not be homogeneous – for example, in the beverage industry, the metric 'litres of beer' is very different from that of 'litres of distilled product'.
- In addition, it is harder to apply for large, diversified companies that operate across sectors (e.g. Siemens).

Expert track: Illustrative example

Chart 10: What's going on?



Source: Kepler Cheuvreux worked example

In the example above:

- Telco 2 has a higher GHG intensity per USDm sales
- However, it uses 63% less energy per customer

⇨ Lower average revenue per customer (larger effect)

⇨ Lower energy efficiency (0.31 vs. 0.23 kg per Kwh) (smaller effect)

Why is that? Telco 1 is mainly based in North America while Telco 2 operates in different regions with a dirtier energy mix.

Table 3: Example of production metrics reported by companies

Sector	Production metric
Tobacco	mt tobacco product, cigarettes
Beverages	million litres of beer, distiller product
Automobile manufacturing	million cars
Utilities	kwh, m3 wastewater treated, tonnes of waste treated
Real estate	m2 floor space
Retail	m2 floor space
Office	m2 floor space, per employees
Telecommunication	gigabytes, customer, kwh
Aviation	passenger.km

Source: Kepler Cheuvreux

Ownership-based versus exposure metrics

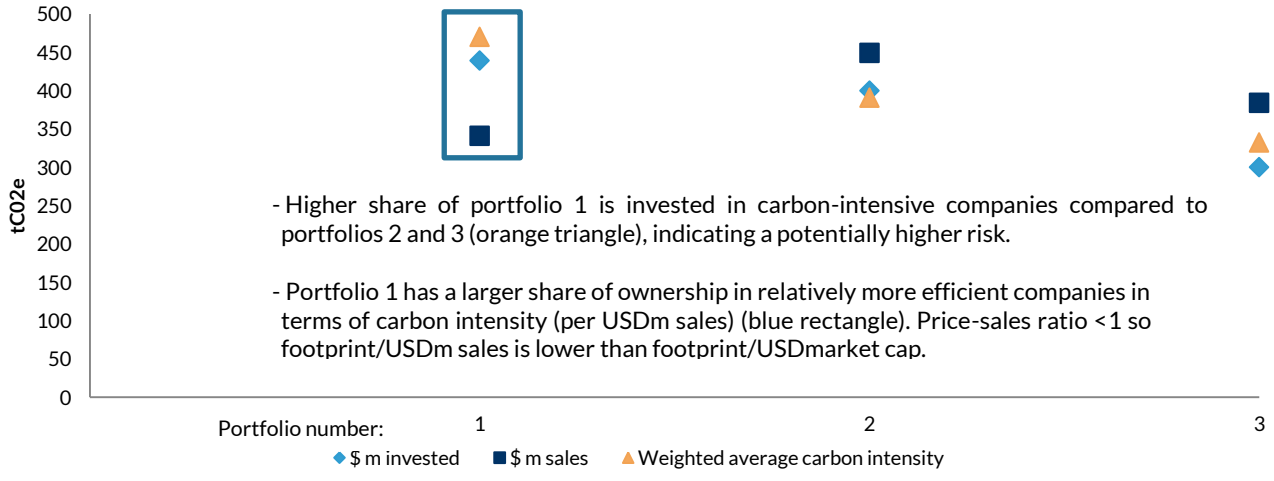
The metrics discussed above are vulnerable to noise introduced by the ownership metric used in the calculation (e.g. for listed equity, USD invested per market capitalisation). In addition, one may argue that climate-related risk is greater for companies with higher carbon intensity, regardless of its market capitalisation. For these reasons, some investors have started advocating for the use of another metric, the **'weighted average carbon intensity'**.

Some investors have started advocating for the use of another metric, the 'weighted average carbon intensity'

Equation (3) $$\sum_n^i Portfolio\ weight * \frac{Issuer's\ emissions}{Issuer's\ sales}$$

This metric is disconnected from ownership and thus does not capture the investor's contribution to climate change, but rather measures the portfolio's exposure to carbon-intensive companies.

Chart 11: What does the comparison between metrics tell us?



Source: Kepler Cheuvreux

Our suggested approach

A survey conducted by MSCI found that out of the 16 asset owners and managers interviewed in May 2015, 31% found that carbon emissions per USDm invested was the most important metric, 25% carbon emissions per USD sales, 25% weighted average carbon intensity and 19% total carbon emissions. In practice, we argue that these metrics may be used together for a better understanding of the results.

- As a first step, we suggest calculating the absolute and relative footprint of the portfolio, normalised by USD invested and claims on sales, as well as the weighted average carbon intensity. This can inform comparisons with another portfolio or benchmark.
- As a next step, the sector allocation and stock selection effect may be investigated to understand what sector or stock (recognising that some may be modelled in the absence of data disclosure) is driving the results. Finally, for selected homogeneous stocks and sectors, the carbon intensity per unit of output is recommended to control for price effects.
- When using the data for stock picking or engagement, we argue that more information on the company needs to be collected, such as information on its business model (is the company vertically integrated or does it outsource all of its production?), in order to understand what drives the carbon footprint at company level.

Table 4: Each metric highlights an important aspect of the footprint

	1. Absolute	2. Normalised by portfolio market value	3. Normalised by portfolio claim on sales	4. Weighted average carbon intensity
What does it tell you?				
Question answered	What is my portfolio's absolute carbon footprint?	What is my normalised carbon footprint per USDm invested?	How efficient is my portfolio in terms of carbon emissions per unit of output?	What is my portfolio's exposure to carbon-intensive companies?
Metrics	t C02e	t C02e/USDm invested	t C02e/USDm sales	t C02e/USDm sales
What can you use it for?				
Comparison across portfolios/against a benchmark	No: does not take size into account	Yes, adjusts for portfolio size	Yes, adjusts for portfolio and investees' size	Yes
Comparison through time	No	Yes	Yes	Yes
Portfolio decomposition and attribution analysis	Yes	Yes	Yes	Yes
Communication	Easier	Average	Harder	Easier
What are the methodological considerations?				
Data needs	Medium: capital invested, market capitalisation, carbon emissions of the issuer.	Medium: capital invested, market capitalisation, carbon emissions of the issuer.	Higher: capital invested, market capitalisation, carbon emissions of the issuer, sales of the issuer.	Lower: carbon emissions of the issuer, sales of the issuer, portfolio weights
Sensitivity	Sensitive to changes in market capitalisation. Can be controlled by keeping ownership metric constant (if the fluctuation in market capitalisation is only due to price changes). Sensitive to currency fluctuations.	Sensitive to changes in market capitalisation. Can be controlled by keeping ownership metric constant (if the fluctuation in market capitalisation is only due to price changes). Sensitive to currency fluctuations.	Sensitive to changes in market capitalisation. Can be controlled by keeping ownership metric constant (if the fluctuation in market capitalisation is only due to price changes). Sensitive to changes in the ratio sales to market capitalisation. Sensitive to currency fluctuations. Sensitive to changes in sales.	Sensitive to outliers. Not sensitive to changes in market capitalisation.
Linked to investment strategy	Yes, through the concept of ownership but less explicit.	Yes, through the concept of ownership.	Yes, through the concept of ownership but less explicit.	No
Refine the analysis and investigate:				
Sector allocation contribution **Stock selection contribution**				
1. Carbon intensity per unit of output 2. Business model of the company				

Source: Based on MSCI

What about other asset classes?

While the overwhelming majority of carbon footprint analysis has been done on publicly-listed equity portfolio so far, asset owners and data providers are investigating methodologies that could be applied to other asset classes, such as fixed income, private equity and sovereign bonds.

When calculating the footprint of a multi-asset portfolio, questions arise around double counting. Our recommendations around double counting between Scopes 1, 2, and 3 apply in this case as well (Chart 8).

When calculating the footprint of a multi-asset portfolio, questions arise around double counting

Our recommendations around double counting between Scopes 1, 2, and 3 apply in this case as well

Table 5: Extending the analysis to other asset classes

Data availability	
Fixed income	Use the same carbon data as public equity. Allocating carbon emissions to fixed income requires additional data on the liabilities of the investee and the market price of its shares and bonds.
Private equity	Lower availability of environmental data. Estimation techniques based on sectors can be used. An alternative consists in contacting the company to run a corporate carbon footprint.
Sovereign bond	For Scopes 1 and 2, emission data of the government organisation, allocated based on the % financed out of the total financial balance of the country (or national debt). For Scope 3, country level emissions can be used. The question revolves around the choice between emissions produced on the territory or emissions due to the consumption of goods and services within a country but potentially emitted outside of the national territory.
Project finance, infrastructure	Methodologies exist to assess the carbon footprint of such projects throughout their lifetime, usually developed and used by Development Banks.
Real estate	Methodologies are moving quickly towards unified metrics (C02e/m2, CO2e/kWh). Initiatives such as GRESB is a potential data source.
Double counting	
Option 1	**Accept double counting**: for example, 100% of the investees' carbon footprint is allocated to equity, and another 100% is allocated to debt holders.
Option 2	For double counting between fixed income and equity, an alternative method is the "Share of investment approach". The carbon footprint is allocated between equity and debt-holders based on enterprise value. Note that no method has been developed to avoid double counting between other asset classes to our knowledge, apart from restricting the analysis' perimeter to Scopes 1 and 2.

Source: Kepler Cheuvreux

Treshold Group and Trucost released a whitepaper recently for consultation on the carbon footprint of derivatives of listed equities, corporate bonds and indexes (link).

Expert track: let's deep-dive into enterprise value!

Enterprise value has been suggested as an alternative allocation metric to avoid double counting between equity and fixed income. As highlighted before, we note that the only use case for allocating emissions between equity and fixed income is to disclose climate change contribution at portfolio level.

Enterprise value is an imperfect metric.

- In the enterprise value calculation, "cash" is subtracted from debt. This creates a bias in the calculation, as the enterprise value may be negative in certain cases.
- Two companies may have the same carbon intensity but may be leveraged in different ways, thus leading to different intensities when calculated from the equity or the bond perspective. This creates an **artificial difference**, solely due to leverage and not to real-world use of funds.

Enterprise value has been suggested as an alternative allocation metric to avoid double counting between equity and fixed income

How are data gaps estimated?

A large number of companies do not disclose their GHG emissions, in particular Scope 3 emissions. A 2014 study by Corporate Knights based on 2012 data found that only 39% of the 4,000+ largest publicly-listed in the world disclosed this type of data (link). We find a similar figure for our universe of covered companies.

There are several techniques to estimate data gaps. Here, we focus on life-cycle analysis, environmentally-extended input-output models (EEIOs), and disclosure averages and regression analysis. In practice, data providers will use one or more of these techniques, depending on the type of analysis and the sector.

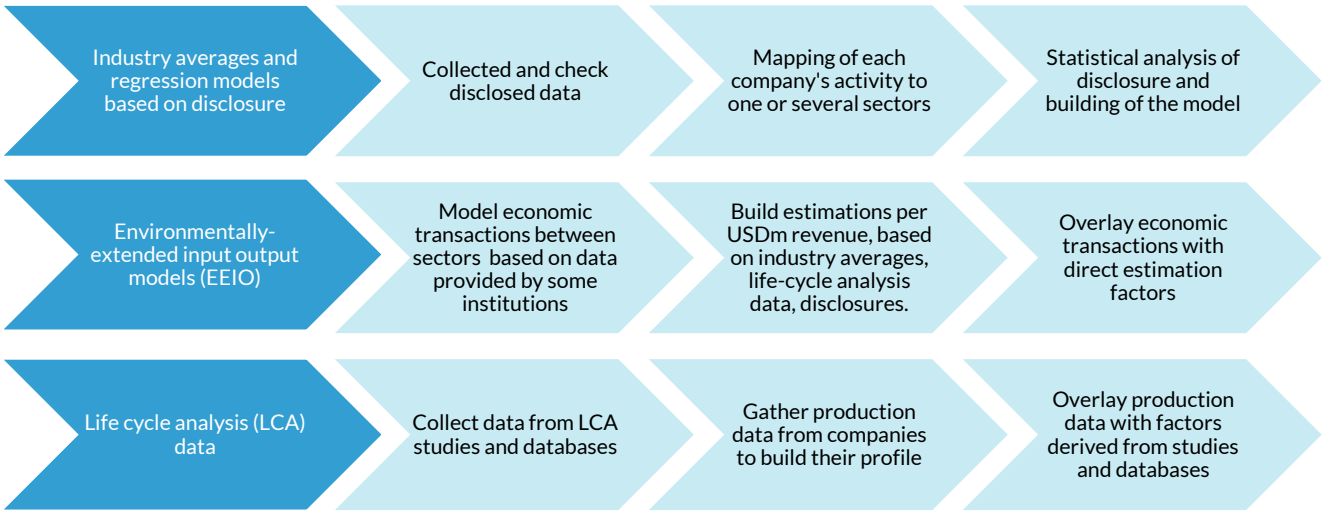
In practice, data providers will use one or more of these techniques

Upcoming work of the CDP, with in partnership with Enviance and two professors from the Carnegie Mellon University, has been focussing on developing a set of models to estimate Scope 1, 2 and relevant Scope 3 emissions for over 1,300 of the world's higher-emitting public companies. The methodology will be publicly available under creative commons license (link).

Note that these estimation techniques require an analysis of the investee's activity – whose granularity is a factor contributing to uncertainty.

- Listed companies are not legally required to report the breakdown of their sales by product category, or activity, and practices in this area are not standardised.
- To match a company's activity data with the sectors covered by their models, most practioners perform in-house segmentation analysis. This approach is mostly applied to company sales, but some also apply it to governmental and household expenditures (for sovereign bonds and consumption loans).

Chart 12: What are the methodological steps to estimate data gaps for each of these options?



Source: Kepler Cheuvreux

Industry averages and regression models based on disclosure can be used to estimate Scopes 1, 2 and 3 – but has most often been used to estimate Scope 1 and 2, apart from ET Index and upcoming CDP work. The core principle is based on the identification of the correlations between the carbon footprint reported by companies and their activity data, in each industry-group, potentially using revenue segmentation.

Industry averages and regression models based on disclosure can be used to estimate Scopes 1 and 2

Some data providers have developed their own industry classification in order to refine the estimates, while others refine the results by using an alternative industry classification such as SASB. Upcoming work from CDP uses BICS business segmentation (Bloomberg Industry Classification System).

Table 6: Key considerations to assess industry averages and regression models

What are the key differences between existing models?	
Classification	Either based on proprietary, alternatives (SASB), or mainstream (Industry)
	Higher level of effort to develop proprietary classification or use of alternatives to map companies
	Proprietary and alternatives may (everything else being equal) give better results as designed for this purpose
Granularity of sectors	Higher level of granularity may better take into account the specificities of the company
	However, many companies do not report their revenue in a granular way, so it may be a waste of time
	Very limited number of pure players (companies operating only within one sector) that can be used to derive averages for each sector, especially at a higher level of granularity
Estimation method	From simple averages to sophisticated models taking into account sector allocation, relationship with market cap and other variables such as employee count
	Unsure about the materiality on the overall results
Estimation model	Based on average or regression model. Variability through time when the data sample changes?
Can it be used to estimate the GHG footprint of other asset classes?	
Private equity	Yes, if company discloses sector-split and other relevant data points
Fixed income	Same as private equity
Sovereign bonds	Can be mapped to a 'governmental' sector to estimate Scope 1 and 2 (although it may be harder to do in practice as different models account for the governmental sector differently). Derived coefficients can be used to estimate total country footprint, based on sectorial GDP data, to estimate Scope 3.
Infrastructure, project finance	If revenue data is available. Emissions will be yearly emissions (as opposed to lifetime).
Real estate	Possible to use data from GRESB (per m^2) or CRC Energy Efficiency Scheme data in the UK.

Source: Kepler Cheuvreux

Environmentally-extended input-output models (EEIO) quantify the economic exchanges between industries in order to calculate the carbon emissions per USD of revenue for each industry on product category. These emission factors include only direct and supply chain emissions (Scopes 1, 2 and 3 upstream).

EEIO emission factors include only supply chain emissions (Scopes 1, 2 and 3 upstream)

Table 7: Key considerations to assess EEIO models

What are the key differences between existing models?	
Underlying spend matrix	Is it based on the US economy (most common)? How old is it (often 2007 but can go back to 2002)?
	This will have an impact on sectors that do not exist in the US economy (e.g. palm oil) and that have changed dramatically in the past ten years (telephone and electronics manufacturing).
Granularity of the sector segmentation	Higher level of granularity better in order to take the specificities of the company into account
	Many companies do not report their revenue in a granular way so it may be a waste of time
Source of estimation factors	How old are they? Are they global or country-specific?
Can it be used to estimate the GHG footprint of other asset classes?	
Private equity	Yes, if company discloses sector-split and other relevant data points
Fixed income	Same as private equity
Sovereign bonds	Can be mapped to a 'governmental' sector to estimate Scopes 1 and 2. Derived coefficients can be used to estimate total country footprint, based on sectoral GDP data
Infrastructure, project finance	If revenue data is available. Emissions will be yearly emissions (as opposed to lifetime).
Real Estate	If revenue available, possible to map to a 'real estate' sector.

Source: Kepler Cheuvreux

Expert track: are there any publicly-available models I can use?

Most EEIO models are proprietary

Most EEIO models are proprietary. The Carnegie Mellon University model is free to use directly on their website, although for non-commercial use (link). The model covers 428 sectors and estimates the full upstream (supply chain) emissions. The main caveats of this model are:

- The economic exchange data that underpins the model are based on the US economy. It can be used as a proxy for other countries but this will introduce errors when modelling Scope 2 emissions (due to different country electricity mix, if not adjusted) and sectors that do not exist in the US (e.g. palm oil).
- The model is based on 2002 data and does not take inflation into account. This may not be a problem if the user inputs deflated revenue data. Some sectors have dramatically changed since then (e.g. telephone apparatus manufacturing).
- All Scope 3 upstream and Scope 2 emissions are aggregated. The model can be used for Scope 2 and upstream Scope 3 emissions only.

Life-cycle analysis (LCA) provides emission factors per unit of output for each stage of the life-cycle and can therefore be used to estimate each scope (Scopes 1, 2, and 3, both upstream and downstream). Carbon data exist for most types of raw material (e.g. barrels of oil, tonnes of cement) and manufactured product (e.g. car, appliances).

Life-cycle emission factors provide emission factors per unit of output for each stage of the life-cycle and therefore each scope

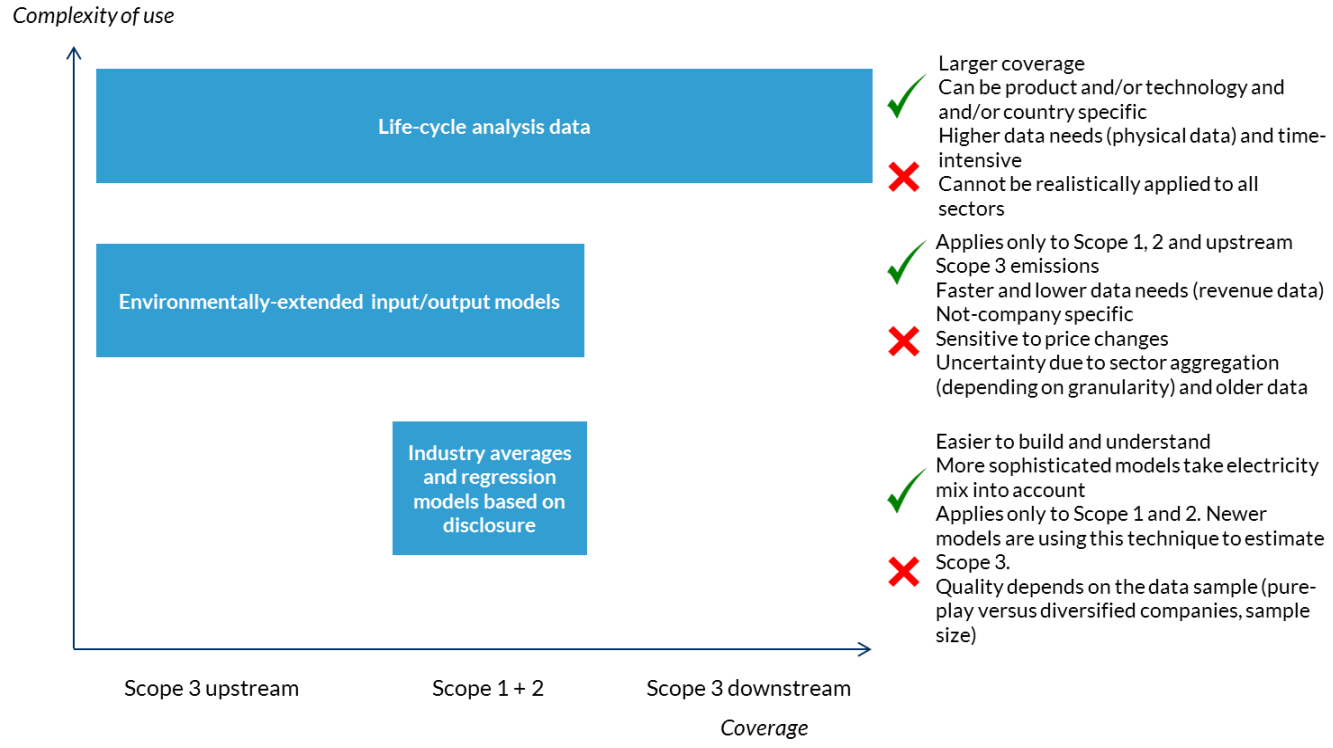
Analysts need to be careful when processing the data to make sure it is comparable – even though the LCA route may not make sense for investors trying to do their portfolio carbon footprint due to the difficulties and time involved. LCA-based analysis may be more useful for other asset classes (e.g. project finance).

Expert track: Where can I find life-cycle analysis data?

Potential sources of life-cycle analysis emission factors include:

- A list of life-cycle databases that can be found on the GHG Protocol website (link).
- The GHG Protocol, which also provides excel-based tools to calculate emissions in the following sectors: Adipic Acid, Nitric Acid, Aluminum, Pulp and Paper, Ammonia, Refrigeration and Air-conditioning equipment, cement, semi-conductors, HCFC-22, Iron and Steel, lime and wood products.
- A well know database, Ecoinvent (not free, can be accessed online or through life-cycle analysis softwares such as Gabi or Simapro).
- Defra, which provides emission factors for some Scope 3 categories, including purchased goods and services and waste generation (link).
- The GHG Protocol, in partnership with Quantis, offers a free, web-based tool to calculate Scope 3 emissions at investee-level (link).

Chart 13: Pros and cons of each estimation method



Source: Kepler Cheuvreux, 2° Investing Initiative

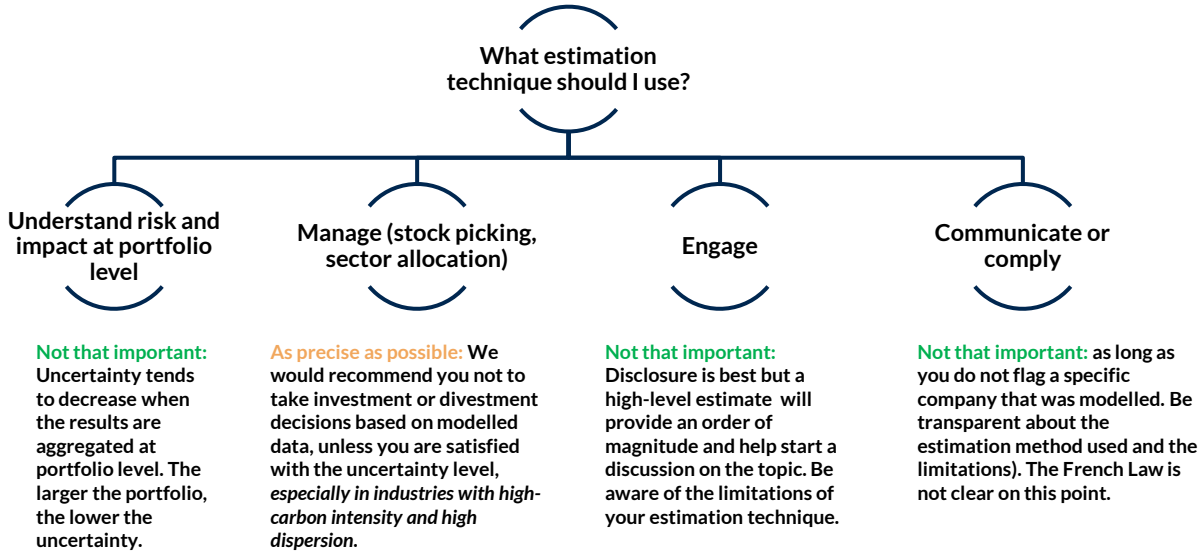
Tradeoff between granularity and level of effort in the choice of methods

There is a trade-off between granularity and level of effort in the choice of estimation methods. What can be done? These techniques differ in complexity and coverage and we believe they are best used in combination.

- In the choice between disclosure averages and more sophisticated methods such as EEIO models and life-cycle analysis data, it depends on how diversified the company is, how granular the industry classification is, and how many disclosures were used when deriving the industry averages. We would argue that disclosure averages are good as a first 'screen' for Scope 1 and Scope 2 emissions. It may be harder to apply these averages to Scope 3 emissions due to a lack of disclosures, although some providers have developed methodologies along these lines.
- EEIO models are a more sophisticated way to estimate gaps, based on industry averages. They offer a good alternative to industry averages for Scope 3 emissions in particular. However, compared to LCA, the use of monetary metrics (revenue/price) as an input in the model may distort the results, due to different pricing strategies.

As a conclusion, we would recommend starting with estimates derived from EEIO models or averages, as a first screen. The second step is to overwrite high-footprint sectors with production-based data for Scope 1, 2 and upstream Scope 3 emissions, where possible. LCAs can also be used to estimate downstream Scope 3 emissions.

Chart 14: Decision tree – what estimation technique is best suited to each use case?



	Carbon intensity (S1 and 2)	Relative % of S1 and 2 (versus total S 1, 2 and 3)	Relative dispersion
Basic materials	Higher	70%	Higher – especially Construction & Materials, Mining, Forestry and Paper
Consumer goods	Average	30%	Higher – especially Personal Goods, Tobacco
Financials	Lower	25%	Average
Health Care	Lower	45%	Lower
Industrials	Higher	40%	Higher – especially Industrial Metals, Chemicals
Oil & gas	Higher	10%	Higher - especially Producers
Technology	Lower	40%	Lower
Telecommunications	Lower	50%	Lower
Utilities	Higher	75%	High – especially Electricity, Gas & Water, Alternative Energy

Source: Kepler Cheuvreux, South Pole Group, Grizzly

How can I assess data quality?

Quality is mostly a concern when making decisions based on the data.

Data quality concerns arise from reporting boundaries, emission factors and estimated data

For disclosed data, quality concerns arise from:

- The quality of reporting, particularly the accuracy and completeness of data, is inconsistent across companies. Verification against a standard, such as AA1000, is one way to check the quality of the data. Common issues include reporting on only one business unit or country (inadequate boundaries), not including other greenhouse gases beyond carbon, unit problems or simply a misplaced comma!
- In most cases, carbon data provided by reporting companies for Scopes 1 and 2 are based on the application of emission factors to primary energy, raw material consumption, and electricity purchases. The uncertainty of the related emission factors ranges from 5% (oil, gas and coal) to 10-15% (electricity).

For estimated data, quality problems arise from:

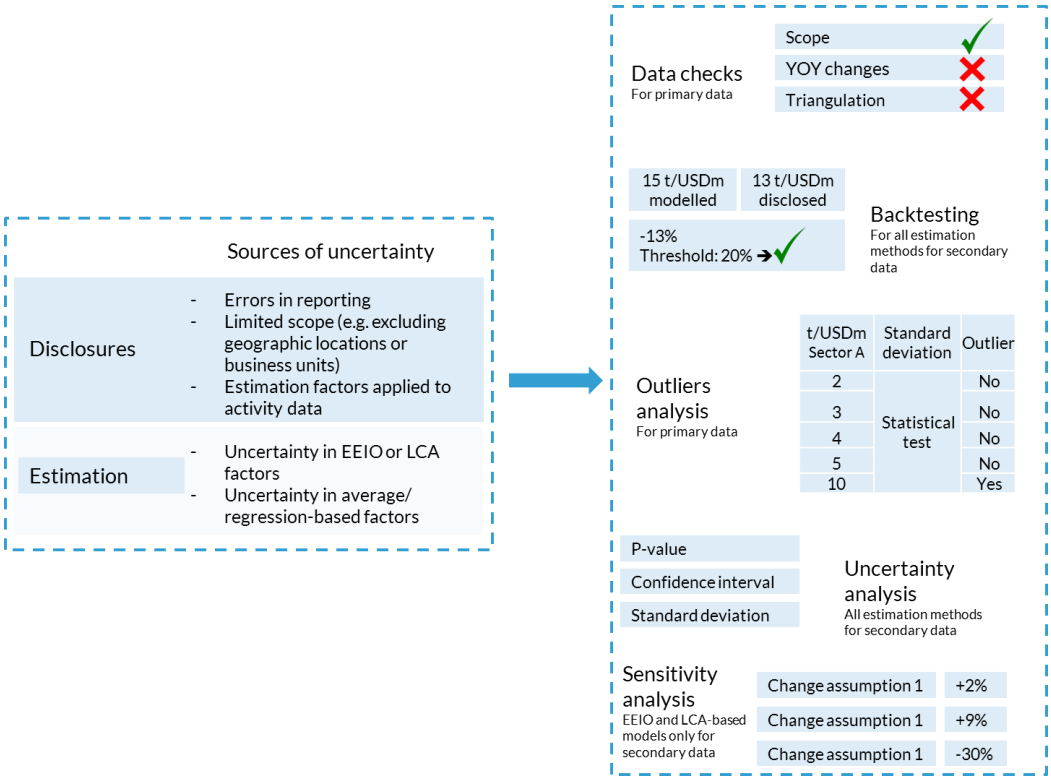
- When practitioners apply process-based emission factors to outputs reported in physical units (oil barrels, tonnes of cement, etc.) by the

companies, the level of uncertainty varies greatly between types of products and industries. In many cases, the precision of activity data reported necessitates the use of industry averages rather than process-specific factors, which in turn leads to additional uncertainty (in some industries differences between old/innovative processes can be as high as 100% compared to the benchmark).

- EEIO and regression-models are top-down and bottom-up approaches used to derive averages, which can lead to significant over or under-estimations.

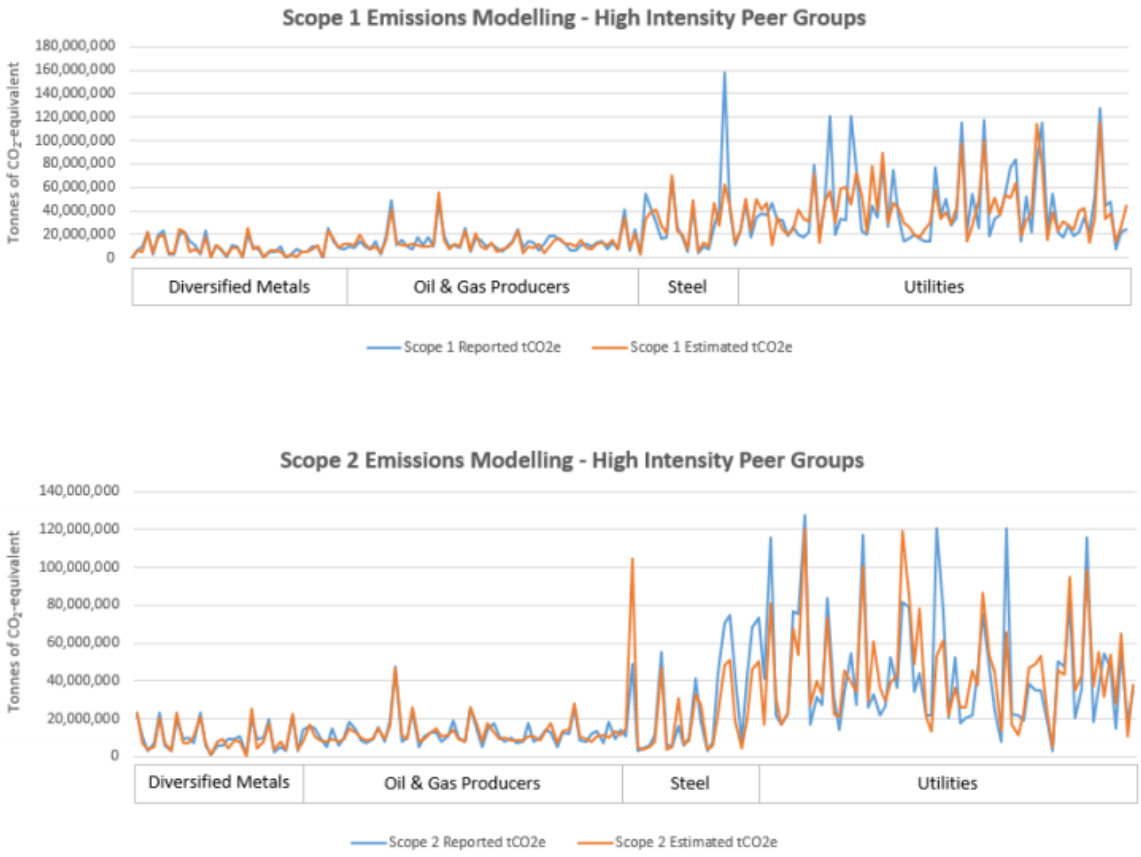
Does it still make sense for investors to implement a best-in-class methodology given the level of uncertainties? We believe that it does, as long as there is an understanding of how uncertain the results are. There are several methods to limit the risk of error, assess and quantify uncertainty, including data checks, back-testing estimated data against disclosure, outlier analysis, uncertainty analysis and sensitivity analysis.

Chart 15: Sources of uncertainty and methods to estimate it



Source: Kepler Cheuvreux

Chart 16: What does 'backtesting' look like?



Source: Sustainalytics

The perspective of the verifier – Contributed by Deloitte

Many listed companies still do not report at all on GHG emissions or do so with a very limited approach. Despite the incredible progress made by companies and the development of reporting tools and standards in recent years, **the challenge remains to get all major companies to report on their energy consumption and carbon emissions using similar standards and perimeters**. The latest CDP Global Climate Change Report 2015 (link) has taken into account around 2,000 major companies worldwide – 55% of the market capitalisation globally – and has listed some key actors of the global economy that do not respond to the initiative. CDP non-responders are mainly located in the US and in Asia (China and Hong Kong), where market and legal expectations are perhaps more limited.

The challenge remains to get all major companies to report on their energy consumption and carbon emissions using similar standards and perimeters

On the opposite end of the spectrum, leading companies identified by the CDP as "A List" have common characteristics and reach a high level of external verification of Scope 1 and Scope 2 carbon emissions. CDP and other stakeholders acknowledge that **an external assurance provides relevant evidence of the level of reliability of reported information**. Nevertheless, among the CDP responders (which are already the most involved in terms of carbon reporting), the percentage of companies providing verified emissions (covering at least 70% of reported emissions) is 64%. In addition, this rate is also quite heterogeneous depending on country or region.

Table 8:External verification rates vary by country

Country/Region	Number of CDP responders	% of external verification of scopes 1 & 2 disclosed carbon emissions
France	95	88%
Korea	74	86%
Spain	42	86%
Ireland	11	82%
Portugal	11	82%
Italy	47	81%
South Africa	74	77%
Hong Kong & South East Asia	42	71%
Benelux	47	70%
India	49	67%
UK	232	66%
USA	334	65%
Latin America	25	64%
Japan	230	63%
Nordics	147	59%
Austria, Germany & Switzerland	155	58%
Australia / NZ	97	57%
Brazil	55	49%
Canada	100	49%
Turkey	30	47%
Central & Eastern Europe	7	22%

Source: CDP Global Climate Change Report

A relevant and reliable GHG emission reporting requires transparency on assumptions and methodologies used, especially regarding the following key aspects:

- Reporting boundaries and periods and gaps with financial information should be disclosed and explained.
- Reporting criteria or guidelines have to be available to stakeholders and key characteristics may be part of the disclosed information.
- Compliance with an external guidance or protocol (such as GHG Protocol) is a sign of quality, particularly if an external assurance is provided.
- Estimates and avoided emissions are very sensitive to hypotheses and reference data. The use of such information must be done in a particularly precautious manner.

Expert track: Key concepts regarding assurance

According to the *International Framework for Assurance Engagements* proposed by the IAASB (International Auditing and Assurance Standards Board), an "Assurance engagement" means "*an engagement in which a* ***practitioner*** (e.g. an auditor) *expresses a* ***conclusion*** (within an assurance report) *designed to enhance the degree of confidence of the* ***intended users*** (e.g. the shareholders) *other than the* ***responsible party*** (e.g. the reporting company) *about the outcome of the evaluation or measurement of a* ***subject matter*** (e.g. GHG emissions) *against* ***criteria*** (e.g. guidelines to establish GHG emissions)".

The practitioner is required to observe the fundamental ethical principles of the professional Ethics Codes, including: Integrity; Objectivity; Professional competence and due care; Confidentiality; and Professional behavior. The practitioner gathers sufficient appropriate evidence to provide a reasonable

basis for expressing a conclusion in an assurance report.

Two types of assurance engagement can be performed: a reasonable assurance engagement and a limited assurance engagement.

- The objective of a **reasonable assurance** engagement is a reduction in assurance engagement risk to an acceptably low level in the circumstances of the engagement as the basis for a positive form of expression of the practitioner's conclusion. For example: "*In our opinion internal control is effective, in all material respects, based on XYZ criteria.*"
- The objective of a **limited assurance** engagement is a reduction in assurance engagement risk to a level that is acceptable in the circumstances of the engagement, but where that risk is greater than for a reasonable assurance engagement, as the basis for a negative form of expression of the practitioner's conclusion. For example, "*Based on our work described in this report, nothing has come to our attention that causes us to believe that internal control is not effective, in all material respects, based on XYZ criteria.*"

The level of assurance is not an evaluation or a result of the degree of compliance of the subject matter with the criteria but rather a level of confidence depending on the diligence performed by the auditor (and decided at the beginning of the assignment).

The subject matter must be appropriate, which means:

- Identifiable, and capable of consistent evaluation or measurement against the identified criteria; and
- Such that the information about it can be subjected to procedures for gathering sufficient appropriate evidence to support a reasonable assurance or limited assurance conclusion, as appropriate.

The criteria must be suitable, which means it must exhibit the following characteristics:

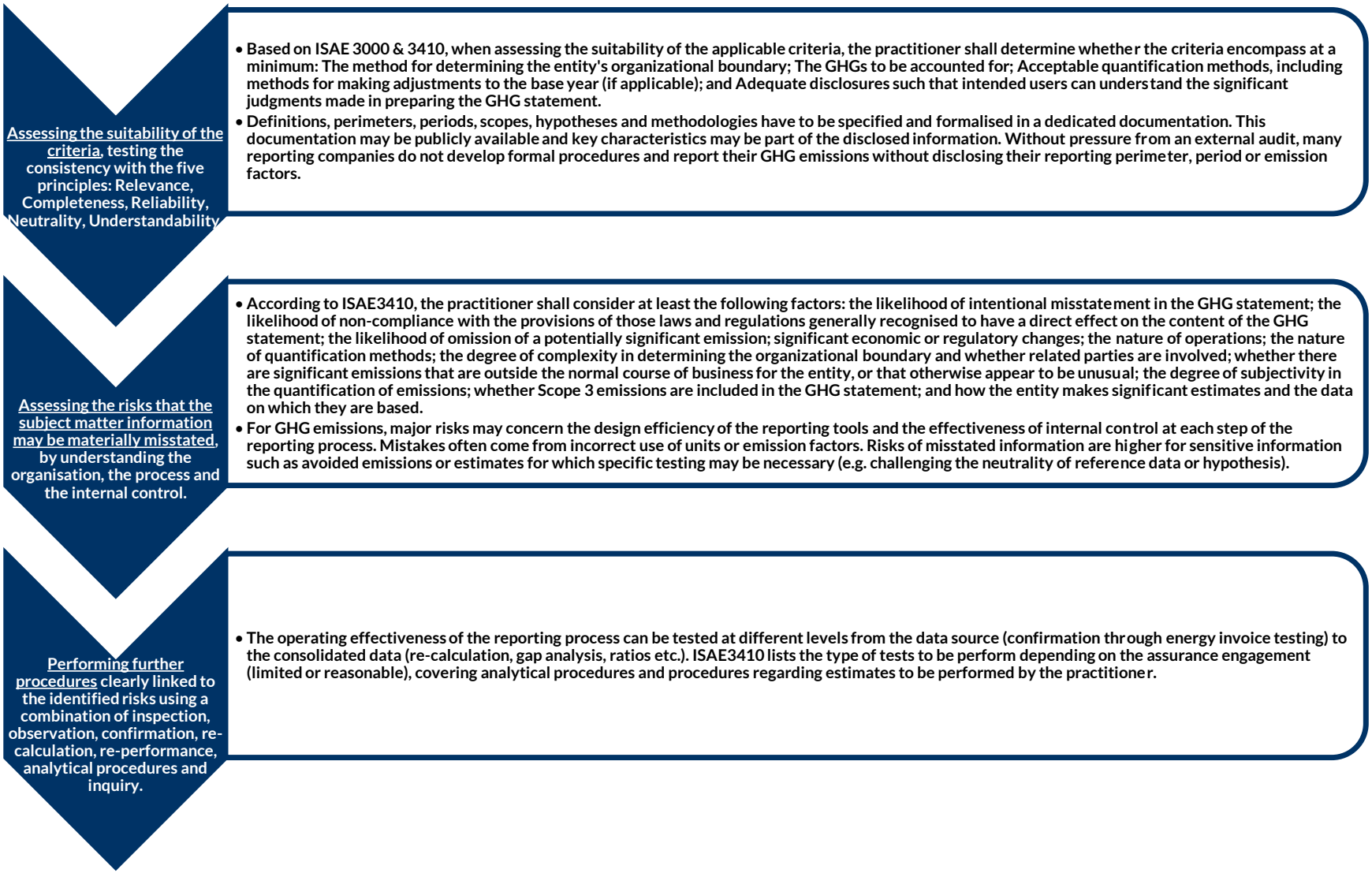
- Relevance: relevant criteria contribute to conclusions that assist decision-making by the intended users.
- Completeness: criteria are sufficiently complete when relevant factors that could affect the conclusions in the context of the engagement circumstances are not omitted. Complete criteria include, where relevant, benchmarks for presentation and disclosure.
- Reliability: reliable criteria allow reasonably consistent evaluation or measurement of the subject matter including, where relevant, presentation and disclosure, when used in similar circumstances by similarly qualified practitioners.
- Neutrality: neutral criteria contribute to conclusions that are free from bias.
- Understandability: understandable criteria contribute to conclusions that are clear, comprehensive, and not subject to significantly different interpretations.

The evaluation or measurement of a subject matter on the basis of the practitioner's own expectations, judgments and individual experience would not constitute suitable criteria.

Within the International Framework of Assurance Engagements, two specific assurance standards developed by the IAASB are used for non-financial information:

- ISAE3000: Assurance engagements other than audits or reviews of historical financial information – used to provide assurance on ESG information;
- ISAE3410: Assurance engagements on GHG statements – dedicated to carbon emissions and used jointly with ISAE3000.

Chart 17: Tasks performed by the auditor



Source: Deloitte, based on ISAE 3000 & 3410

Overall, delivering assurance to GHG emissions according to international standards means that:

- The quantification methods and reporting policies selected and applied are consistent with the applicable criteria and are appropriate.
- Estimates made in preparing the GHG statement are reasonable.
- The information presented in the GHG statement is relevant, reliable, complete, comparable and understandable.
- The GHG statement provides adequate disclosure of the applicable criteria, and other matters, including uncertainties, such that intended users can understand the important judgments made in its preparation.
- The terminology used in the GHG statement is appropriate.

The assurance report discloses key information for users on: the level of the assurance (limited or reasonable); the scope of the assurance (the assurance may not cover all the reported emissions); the type of works that have been performed and their coverage (sites concerned, percentage of data tested, etc.); the conclusion of the assurance, which may be a qualified opinion (that is to say a limitation of the assurance).

Expert track: Designing "assurable" portfolio carbon footprinting

Even if providing assurance to a portfolio carbon footprint might not be expected yet in all jurisdictions, applying assurance principles may lead asset managers and investors to implement more appropriate methodologies and tools. Audit culture and principles may help.

Here are some key recommendations while designing or implementing a portfolio carbon footprint:

- Formalise the process in a dedicated written protocol (i.e. a formal "criteria") which shall include: a description of the process, the definitions of notions and indicators, the sources and methodologies used, the hypotheses and calculations made, the estimate rules, the internal organisation, roles, responsibilities and controls, the expected documentation, etc.
- Check the approach regarding the principles for "suitable criteria": relevance, completeness, reliability, neutrality, understandability.
- Avoid "black box" solutions: main characteristics or hypotheses may be documented and available to users.
- Take into account the different levels of reliability of GHG emissions reported by companies (perimeter, emission factors, estimations, scopes and level of assurance etc.) – do not take reported data for granted.
- Disclose material assumptions used to assess carbon footprint of portfolio.

Carbon footprint: an appropriate measure of risk?

We explore alternatives and/or complementary metrics in the next chapters

Carbon footprint is a static measure: it gives a snapshot in time of what the emissions are for a given asset or portfolio. It is simple, easy to understand and compare, but it captures only one aspect of the story.

Carbon intensity is an incomplete measure of risk: a forthcoming report from Grizzly and 2° Investing Initiative highlights the weak correlation (circa. 0.2) between the assessment of the carbon risk exposure of companies and their carbon intensity.

Additional internal and external factors need to be taken into account:

- Internal factors include, among others, past emissions (litigation risk), and locked-in emissions (impairment risk), exposure metrics (e.g. geographical breakdown of sales, supply-chain) and resilience metrics (e.g. cash available, ability to relocate, pricing power).
- External factors include policies and regulations, client's and customers' sensitivity to climate factors, and vulnerability to extreme climate events.

Not does only carbon footprint need to be overlaid with other information but new metrics also need to be used to get a better understanding of risk. Here, we explore methodologies that use carbon footprint as an input into the risk analysis. In later parts, we study technology/asset-based metrics and benchmarks.

Shadow pricing: multiple applications from price to external cost

Some providers offer to overlay the portfolio footprint results with monetised values. Two types may be distinguished:

- **Approximation of what a carbon price may look like.**

Simple analysis may just apply a price for carbon to the Scope 1 emissions of a portfolio, while a more sophisticated one could apply it to multiple scopes and take into account multiple scenarios, the type of sector, timing and how this additional cost may be passed through the supply chain based on pricing power and other fundamental analysis metrics.

- **Social cost of carbon, reflecting the damage caused to society, or the cost of the carbon externality. This is a measure of value destruction to external stakeholders, which may be compared to financial metrics such as market value of a portfolio or yearly returns.**

The best-known study of the social cost of carbon is the Stern Report (link), published in 2006, which estimated the social cost of climate change to be as large as 5-20% of global GDP. The analysis was updated recently and found to be higher, at USD32-103 per tonne, likely to rise to USD82-260 in 2035 (link). The US EPA estimates the cost to be USD40, using a 3% discount rate. If the risk of catastrophic events is taken into account, a value of USD120 is recommended. These costs also increase through time (link). Note that another way to estimate the social cost of carbon is to consider the price needed to reach a pre-set objective (cost-efficiency vs cost-damage approach).

While this metric is a measure of social cost, it can also be used to estimate risk. Recently, the Economist Intelligence Unit (link) translated what this means to the asset management industry and estimates the average value at risk to 2100 in discounted, present value terms, to be at USD4.2trn per year. When tail risks are taken into account, the authors find that 6˚C of warming represents present value losses of USD43trn, or 30% of the entire stock of world's manageable assets.

Increasing momentum at company level: an increasing number of companies are disclosing their use of internal carbon pricing (link), ranging from USD1 to USD357, calculated using different methodologies and assumptions, based either on potential market price, the social cost of carbon or another consideration such as the cost needed to reach pre-set objectives.

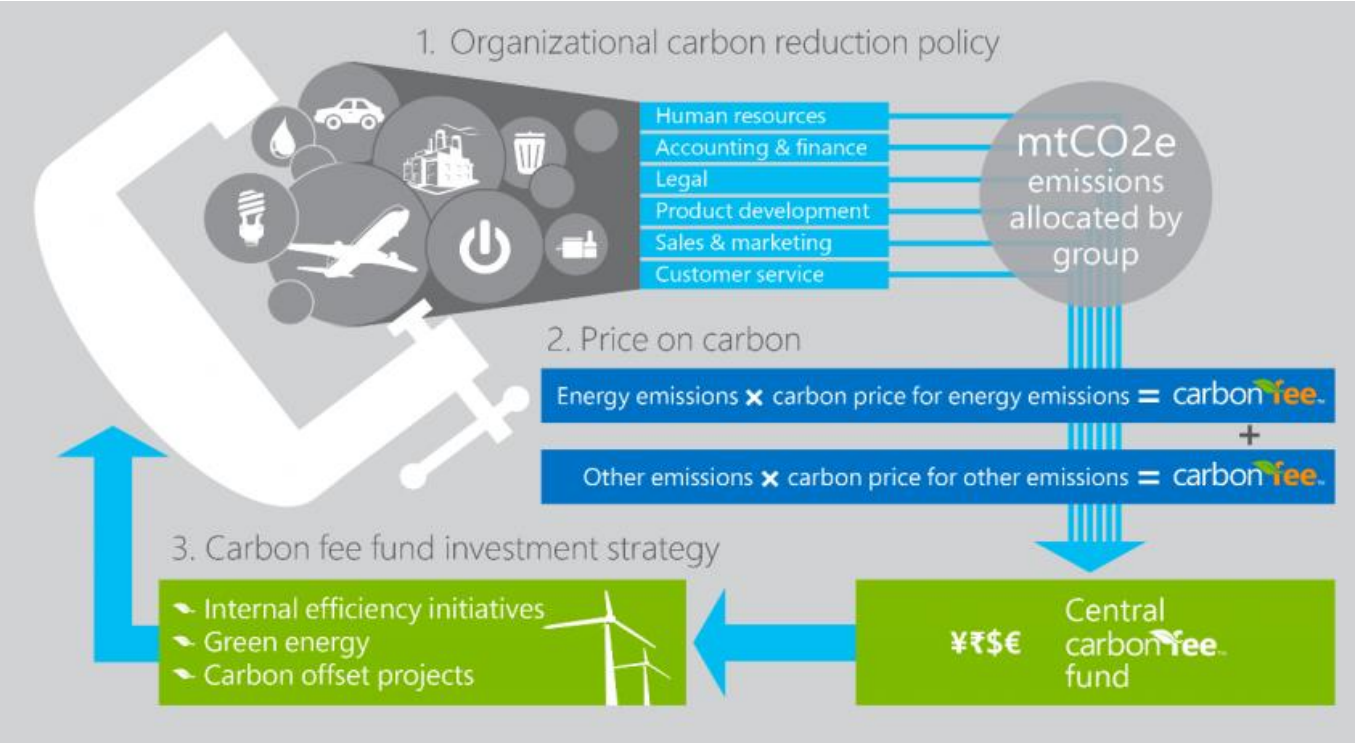
The 'Microsoft Playbook' is an example of the latter: based on the organisational carbon policy and the investment needed to achieve the carbon reduction target, an internal price is set annually (USD4.4/t in 2015). The fee is charged to each department based on its energy consumption, consolidated in a fund and reinvested into energy efficiency, green energy and carbon offset projects.

Table 9: Selected companies that use internal carbon pricing in our universe

Company	Sector	USD per tonne (2015)
Enagas	Utilities	7.86-22.45
EDP	Utilities	5.61-67.35
E.ON	Utilities	22.45-44.90
Iberdrola	Utilities	34
Centrica	Utilities	20
ENEL	Utilities	12
Statoil	Oil & gas	50
ENI	Oil & gas	40
Royal Dutch Shell	Oil & gas	40
Total	Oil & gas	28
WPP	Media	45
Sky	Media	24
Kering	Luxury goods & cosmetics	70
Bic	Home & apparel	11;20
Inditex	General retail	30
Jeronimo Martins	Food retail	6
Holcim	Construction & materials	32
AkzoNobel	Chemicals	122
Solvay	Chemicals	84
Danieli	Capital goods	8
CaixaBank	Banks	11

Source: CDP (2015)

Chart 18: The Microsoft Playbook – an example of integrated shadow pricing



Source: Microsoft Playbook (link)

The return of scoring?

Recently, we have witnessed the return of scoring methodologies that take into account a wider range of quantitative and qualitative indicators to build a more complete assessment. These metrics are useful from the perspective of engagement with companies. For investors interested in climate issues, climate-related indicators used as inputs in the broader scoring can be isolated to find the climate-related qualitative score for a company.

Climate scores usually focus on scoring a company's public climate-related targets and strategies, together with their actual climate friendliness, assessed on the basis of carbon and/or green-brown exposure metrics. While climate scores are usually limited to companies, the Asset Owner Disclosure Project has started adopting this approach to score institutional investors and publish an annual ranking.

- Climate scoring is an effective summary indicator and is likely to offer a more comprehensive overview of the indicators it considers compared to isolated carbon exposure metrics. By extension, a climate rating together with the underlying analysis can potentially provide a more comprehensive picture of a company's climate performance, and hence potential risk.
- Climate-related scoring also faces a number of limitations. First, they are usually subsumed in a broader ESG score. Second, they usually adopt a best-in-class logic within sectors, allowing for example a high score for certain oil and gas companies relating to their peers, even if their business model is fundamentally misaligned with climate goals. Third, the weighting is often subjective, presenting a 'black-box' risk.

Alternative and complementary metrics

Carbon footprinting might be a starting point, under certain conditions and complementary to other metrics, to inform divestment strategies (at stock or sector level) but not reinvestments, hence the necessity to derive an understanding of the positive side of the story.

Beyond divestment, an increasing objective is to reallocate capital to green assets. For example, a coalition of foundations recently launched a "Divest-Invest" initiative. This illustrates the growing focus on reporting the positive contribution to climate performance (+26% between February and July 2015, representing a EUR19,338 investment by 336 investors, according to Novethic).

If you only have five minutes

Another requirement of the French Law?

Point 4 of the decree requires disclosure on the 'contribution to the energy transition'. One potential option is to express portfolio performance as a ratio between measures of 'friendliness' in the numerator and some measure of company or portfolio size, notwithstanding methodological limitations (explored in the next section). More ambitious metrics would benchmark this against a 2° trajectory.

Green-brown share: a maturing family of metrics

At the simplest level, recent efforts have focused on deriving 'green' and 'brown' exposure metrics. These are segmentation indicators that distinguish between climate solutions and climate risks at technology, company or sector level.

This family of metrics is simple to understand and only requires financial metrics, such as the percentage of a portfolio invested in 'green' technologies, companies, or sectors. The challenges arise when trying to first 'qualify' and second 'quantify' what 'green' means.

At the simplest level, recent efforts have focused on deriving 'green' and 'brown' exposure metrics

These are segmentation indicators that distinguish between climate solutions and climate problems at technology, company or sector level

In search of a standard…

In our view, conventional industry classifications are not adapted and may only be used as a high-level screen, to identify brown and grey sectors, at best. Taxonomies are still poorly developed but new approaches are emerging, led by several commercial providers such as FTSE and MSCI.

Open-source projects in the field of green bonds are building activity and technology-specific taxonomies. We believe that one of the most ambitious efforts in this space is led by the Climate Bonds Initiative.

While these classifications may not be easily applicable to companies due to the lack of granular reporting, we believe they pave the way for further research in this field and their findings can be used to derive bespoke taxonomies.

… and supported by a range of metrics

After building a green-brown taxonomy, the next step is to derive appropriate metrics. We argue that these can be classified across two dimensions: point-in-time/ forward-looking and financial/production-based.

Point-in-time metrics, such as current percentage of EBIT from renewable energy, provide information on the current investee's exposure to green-brown themes, while forward-looking metrics, such as future percentage of EBIT, capex or share of research & development invested in renewable energy technology, can be understood as a proxy for future exposure.

Metrics expressed in financial terms (such as sales, EBIT, R&D) are easier to aggregate at portfolio level, but where possible, for specific sectors, production metrics may be more appropriate when comparing performance within one sector.

Our experience

As part of our previous research ("Reporting on Impact" by Samuel Mary) designed to identify 'impact' stocks within our universe, we built our own taxonomy of green activities and applied it at company level. We share our thought processes as well as the challenges we encountered along the way and how we dealt with them.

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We share our thought processes as well as the challenges we encountered along the way and how we dealt with them

Can you tell me more about 'avoided emissions'?

The 'green' share is a segmentation indicator by itself, but it does not indicate the magnitude of emissions saved. Some data providers, asset managers and banks have attempted to quantify avoided emissions attributable to 'green' products and services. While standardised methodologies exist at a project level, this field of research suffers from a lack of standards at product, company and portfolio level. The Greenhouse Gas Protocol is working on a research paper that will assess whether a credible avoided emissions accounting method can be developed and drive low-carbon product innovation. The first draft is planned for spring 2016.

What can you use it for?

Good for:

- Negative/positive screening for project finance and corporate bonds.
- Portfolio construction for listed equities together with carbon metrics.
- Engagement on different technologies.
- 'Avoided emissions': understanding the magnitude of the positive contribution.

Not so good for:

- Systematically comparing companies and sectors, due to a lack of green-brown taxonomy applicable across asset classes and standard for calculating avoided emissions.
- Understanding the connection with a scenario shown to feasibly transition to the low-carbon economy.

Improvements needed:

- Better, more granular and standardised reporting from investees on green-brown activities (both point-in-time and forward-looking).
- Clearer taxonomy of green and brown sectors, activities or technologies.
- Standards to calculate avoided emissions at corporate and portfolio level.

Fasten your seatbelt

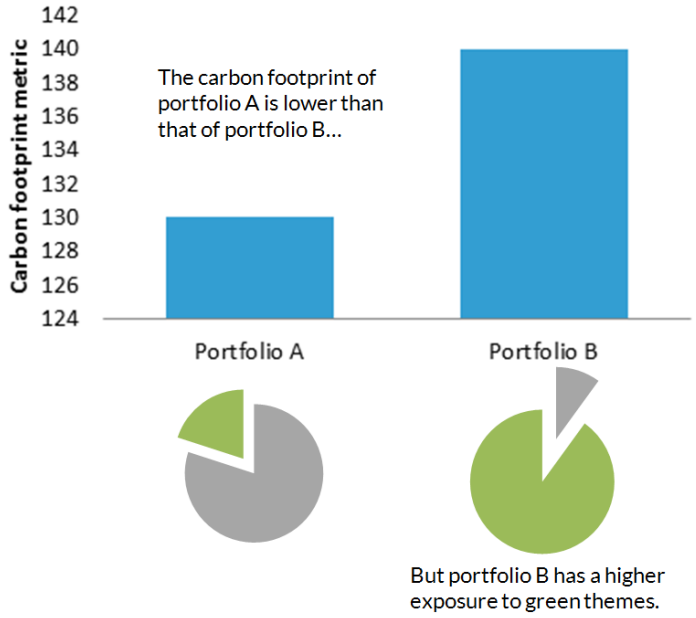
In this section, we answer the following questions:

What else can green-brown metrics tell me?

At portfolio level, carbon footprint metrics cannot distinguish between a low-carbon portfolio built with non-industrial assets (software, service) that does not significantly contribute – in positive or negative - to the energy transition, and another portfolio composed of low-carbon part-of-the-solution industries, such as renewables or green housing. In addition, making decisions solely based on carbon intensity may lead to the exclusion of certain companies with high carbon footprints, which are nevertheless contributing to the climate and energy transition.

Green-brown metrics attempt to focus on this side of the story.

Chart 19: Carbon footprint is an incomplete metric…



Source: Kepler Cheuvreux

Expert track: example at portfolio and investee-level

For example, the carbon intensity (t C02/USDm) of the MSCI ACWI ex Coal index is only 4% lower than MSCI ACWI's (and 13% lower for the MSCI ACWI ex Fossil Fuels Index). At the same time, the reduction in carbon reserves normalised by market cap is larger: -44% for the ex-Coal Index and -100% for the ex-Fossil Fuels index. At investee-level, we investigated the carbon intensity (C02e/USDm) of a few of the energy utilities companies that we cover. Within the sample we chose, Verbund and Iberdrola have the highest footprint. Yet, both invest in renewable energies (94% of electricity generation for Verbund and 13% of EBIT for Iberdrola). This shows that carbon footprint metrics hide substantial differences in terms of green-brown exposure, and by extension associated risks.

Standard industry classifications: useful or not?

At the highest level, industry classification may be used to segment between green (solution-oriented) and brown sectors (risk-oriented). Major types include the Global Industry Classification Standard (GICS), the Industry Classification Benchmark (ICD) and the Bloomberg Industry Classification System (BICS) built in the listed space, and the North American Industry Classification System (NAICS) and the UN International Standard Industrial Classification of All Economic Activities (ISCI) that cover all economic activities, including outside the listed space.

At the highest level, industry classification may be used to segment between green and brown sectors

While this may be a useful screening step, it is an imperfect solution as this method suffers from several practical limitations, given that traditional classification systems are usually based on revenues rather than on non-financial performance.

Expert track: main limitations of standard industry classifications

These classifications are backward-looking and thus not adequate to capture the contribution to climate change and energy transition.

- **Limitation 1:** this leads to inadequate level of granularity, particularly for emerging sectors such as energy technologies.

These classifications may be better suited for analysing 'brown' and 'grey' sectors, rather than 'green' ones

These classifications may be better suited for analysing 'brown' and 'grey' sectors, rather than 'green' ones. Indeed, they may disaggregate 'green' sectors from others in certain cases, while not catering for others. *For example, ICB has categories for Alternative Energy, Renewable Energy Equipment, Alternative Fuels and Alternative Electricity, but not for green buildings.*

- **Limitation 2:** these classifications rely on one-to-one mapping.

The often-used one-to-one company-sector mapping means that a company needs to have at least 50% of its activities in a 'green' activity to be mapped to a 'green' sector. It is thus likely that 'green' activities of large caps are not captured.

- **Limitation 3:** additional, more granular information is needed for 'grey' sectors: depending on their specific activity, technology or product they may be classified as 'brown' or 'green'.

It may be necessary in certain cases ('grey' sectors) to drill down to specific activities, products and technologies

It may be necessary in certain cases ('grey' sectors) to drill down to specific activities, products and technologies. *This is the case for the food, real-estate, forestry, transport and information technology sectors.*

The **SASB Industry Classification System** (SICS) could be considered as an alternative, as it categorises industries based on resource intensity and sustainability innovation potential. However, beyond the disaggregation of certain sectors such as 'alternative energy' and 'organic and natural foods', we believe that the use of this classification *in the context of green-brown metrics* is limited.

Table 10: Contentious, grey, brown and green sectors

Contentious	Grey	Brown	Green
Gas-fired power, bioenergy, hydropower, nuclear power		Fossil fuels	Solar, wind
Energy efficiency without credentials/standards or from the perspective of fossil fuels or at risk of "rebound effect"			Energy efficiency
	Agri-food Real estate Forestry		
Waste management			Recycling, composting
	Transport		Electric and alternative mobility
	ICT		

Source: Kepler Cheuvreux, CBI, FTSE, MSCI

What about alternative classification systems?

Very few companies are pure-play players in 'green sectors' – this diversification of businesses alongside the lack of segmented data on sales, earning, capex and R&D makes it very difficult to derive appropriate metrics, apart for a few selected sectors and KPIs. **Alternative systems are being developed by data and index providers that allow for a better understanding of the specific activity, technology or product in relation to non-financial performance and more specifically carbon.**

A key question to answer is: how do you define green?

How do you define green?

The Climate Bond Initiative (CBI) is working on activity-based industry taxonomies aligned with climate change scenarios for bonds, and is arguably the most ambitious and multi-stakeholder task, using the latest scientific and academic research, to define eligibility criteria for 'green investments' in fixed income under the Climate Bonds Standard.

> **Test of greenness:** "*The Climate Bonds Scientific Framework anchors the Climate Bonds Taxonomy and standards for certification. The framework gives the latest view of the climate science community, providing analysis on emission mitigation pathways and technology options. The taxonomy has been designed to be consistent with the Intergovernmental Panel on Climate Change (IPCC) AR5 report for both the emissions signature of low-carbon economy required to avoid dangerous climate change and the selection of technologies and practices consistent with that signature.*" Note that in addition to mitigation technologies and practices, some adaptation activities are also included, such as water treatment and low-carbon infrastructure.
>
> **A useful and open taxonomy**: The CBI details a very specific, activity-based taxonomy, freely available on its website (**link**). For 'grey' sectors, it provides detailed guidance to determine eligibility under certain conditions. The framework was adapted by the Investors Coalition on Climate Change, which provides a database of low-carbon investments across asset classes: the Low-Carbon Investment Registry Taxonomy (link).

With some limitations when applied directly to equity: The CBI taxonomy is built to fit a 'project' framework and necessitates a high level of data granularity in terms of exposure to certain activities or technologies, which while feasible in the context of green bonds, is harder to achieve for other asset classes. In addition, there may be a need to broaden the scope to take into account diversification, liquidity and business models constraints.

FTSE has also developed a Low Carbon Economy Industry Classification System that maps companies to 7 high-level sectors and 29 sub-sectors. **MSCI also has its own classification,** across 5 themes and 37 technologies. Both the FTSE and MSCI classifications include themes we would classify as 'contentious' or 'grey' (e.g. biofuels and general waste management). Other data providers have developed their own taxonomy. This is the case for **South Pole Group,** for example, which mixes sectors of publicly-available taxonomies.

These classifications have their own criteria to differentiate what is 'green' from what is not and are better-suited to company-level analysis. Transparency is key in this potential contentious area, so that users can make their own judgment on the outcome, not the process itself. For example, the FTSE classification (soon to be launched) is based on an 'industrial test of utility', which looks at how the investee is economically involved in the solution – including both mitigation and adaptation activities.

Chart 20: FTSE environmental sectors and sub-sectors

Source: FTSE

Avoid the traps

We believe that several traps should be avoided in this type of analysis:

1. **Complementary products/activities**: Green products/activities with 'brown' complementary products/activities. This is the reason why energy efficiency in the oil sector is classified as 'contentious' in our typology (Table 10).
2. **Scope myopia:** Products/activities relying on the production of 'brown' raw materials, energy-intensive during the use phase or necessitating complex, polluting end-of-life treatment.
3. **Product/service use:** should oil used as a feedstock for plastic be considered 'brown'?
4. **Business-as-usual versus marginal focus:** should legal requirements or business-as-usual activities be classified as 'green'?
5. **Static view:** what happens if a company has a large amount of green and brown? The share of 'green' and 'brown' activities may fluctuate through time. Other factors are needed to assess whether the company is on the right trajectory (Chart 21).

There is thus a trade-off between using more granular, activity-based metrics and sector-level mapping

Chart 21: Investigating trends…

Company name	Bituminous coal and lignite surface mining	Bituminous coal underground mining	Coal power generation	Total revenues from coal activities latest reporting year	3-year trend
A2a SpA	0.00%	0.00%	1.47%	1.47%	
Abotiz Equity Ventures inc.	0.00%	0.00%	28.54%	28.54%	
Aboitiz Power Corp.	0.00%	0.00%	27.99%	27.99%	
BHP Biliton Ltd.	13.37%	0.00%	0.00%	13.37%	
Adani Power Ltd.	0.00%	0.00%	97.98%	97.98%	
AES Gener SA	0.00%	0.00%	32.53%	32.53%	
China Shenhua Energy Co. Ltd.	0.00%	67.89%	27.71%	95.59%	

Source: Trucost

What metrics?

Data providers have been working on creating databases with relevant metrics, without going necessarily as far as building an entire taxonomy (link). While still in their infancy, and arguably high-level/uncertain, these datasets aggregate disparate reporting and may help save time.

It is possible to distinguish between two broad types of metrics:

- Point-in-time metrics, such as the percentage of revenue, earnings or profit derived from 'green' and 'brown' products or services, are a snapshot of the current performance.
- Forward-looking metrics (e.g. R&D, reserves, useful life of assets, capex) are used as a proxy for future green-brown exposure. Combined with other metrics, they represent one step further towards an analysis of negative contributions to climate change and/or risk exposure.

Two types of green/ brown metrics: point-in-time and forward-looking metrics…

These metrics can be split between cross-sector, higher-level metrics, such as the share of 'brown' and 'green' in sales/revenue, and sector-specific, more targeted metrics. More broadly, the 'green'/'brown' share can be expressed as a percentage of:

- Financial metrics (revenue, spending, capex, opex, EBIT, etc.).
- Physical, sector-specific metrics (% floor space, % of planned capacity).

… expressed as a percentage of a financial or physical metric

Using a financial metric is better from an aggregation perspective. On the other hand, as seen in our discussion of normalising metrics used in carbon footprinting, **the general rule is that the more the indicator moves away from 'physical reality', the more uncertainty is created, particularly as a result of price effects.** It is therefore preferable when feasible (information available at issuer level and consistent with the scenarios) to take a physical unit, when comparing companies within the same sector.

Table 11: Example of metrics

Sector	Point-in-time	Forward-looking
Oil, gas & consumable fuels	Volume of oil and gas produced each year	Volume of proved and probable reserves (coal, oil, gas, shale gas, oil sands, etc.), reserve replacement ratio, R&D spending, average reserve life
Industry	% of revenue from energy efficiency (insulation, battery, smart grids, hybrid/electric vehicles, industrial automation, etc.)	Climate-related R&D and/or number of patents
Real estate	% of revenue from green certified property, % of floor space covered by properties certified to a sustainable/green building standard	Life time, planned refurbishments and acquisitions
Utilities	% of revenue from alternative energy (wind, solar, biogas, biomass, waste, etc.), % of kWh from alternative energy, current capacity	Planned additional capacity, average lifetime of assets
Transportation and logistics	% of vehicles powered by renewable/ alternative fuels in the fleet	RD spending

Source: Kepler Cheuvreux, 2° Investing Initiative, data providers

Expert track: Locked-in emissions

Emissions accounting is currently performed on an ex-post annual basis using past estimates of emissions. However, as investors seek to transition to more climate-friendly and less risky pathways, it is also important for them to factor in the cumulative future impacts of companies' existing capital stocks and the consequences of their planned infrastructure investments. Given the long life spans of infrastructure assets, investment decisions made in the present will potentially have binding impacts over the long term and can lock an asset onto a defined emissions pathway for several decades.

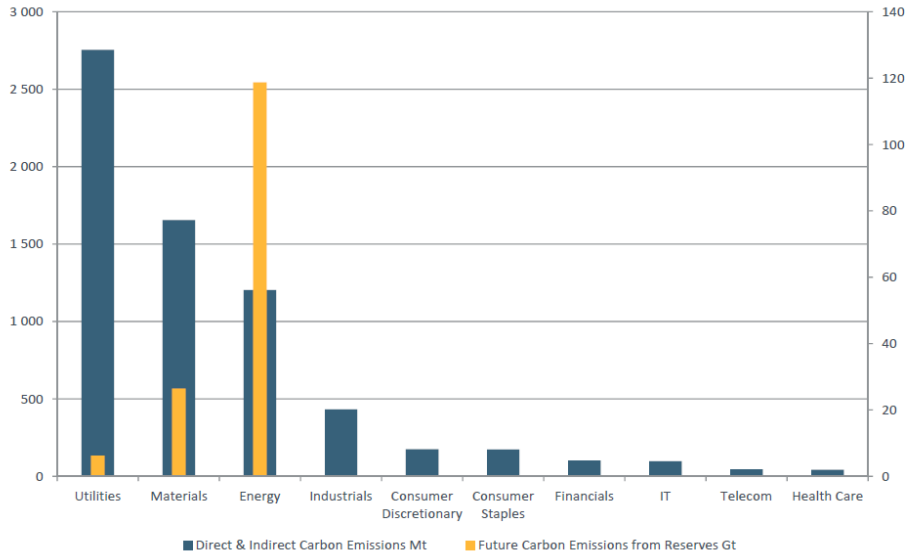
There are three ways to conceptualise locked-in GHG-emissions by sector or industry:

- Locked-in emissions of reserves relate to the GHG-emissions of fossil fuel reserves. They are not technically locked-in with regard to infrastructure

but, as they are booked as reserves on a company's balance sheet, they can be considered locked-in with regard to the associated corporate business plan.

- Locked-in emissions of production capacity relate to all the GHG-emissions associated with the production process of a company planned on its current landscape of assets.
- Locked-in GHG-emissions of the products associated with the production capacity relate to all future GHG-emissions of the products associated with the current and future production capacity of a company. These can for example be the locked-in emissions of airplanes sold by airplane manufacturers.

Chart 22: Point-in-time metrics may hide a large part of the story…



Source: MSCI ESG Research, MSCI ACWI, May 2015

Green share – we did our own: what did we learn?

In this example, we provide an example on the 'green share', based on our experience and our previous report *Reporting on impact*. In order to define our green impact universe, focused on positive environmental outcomes, we had to go through the process of deriving our own taxonomy, mapping companies and assessing the share of their revenue that we consider to be 'green' (*Reporting on impact* by Samuel Mary).

In order to define our green impact universe, focused on positive environmental outcomes, we had to go through the process of deriving our own taxonomy, mapping companies and assessing the share of their revenue that we consider to be 'green'

Developing a green exposure taxonomy, measurement and monitoring on product-based opportunities remains challenging without a framework offering a targeted set of actionable metrics to address practical challenges.

We defined seven environmental clusters associated specifically with climate change mitigation and the transition to a low-carbon economy. To do so, we built

upon the Climate Bonds Initiative (CBI) taxonomy for low-carbon investments (link), itself adapted by the Investors Coalition on Climate Change.

However, despite greater scientific consensus on some of these technological and taxonomical clarifications, our taxonomy remains broader than the CBI taxonomy. As explained before, this taxonomy can more easily be applied to the bond market than to equities, due to its focus on activity rather than companies, given the differences between the two asset classes, namely:

- The diversification of businesses of these listed companies alongside their lack of visibility on sales, earnings, capex and R&D.
- Liquidity, performance and volatility issues.
- A lack of standards in listed companies' reporting on their products' environmental impacts (reference to independently verifiable indicators).
- The importance of stringent standards for the green bond market, where issuers and investors have a particular strong commitment to the green credentials of the activities to which the proceeds are "ring-fenced".

Our vision is the broad green economy: i.e. it incorporates companies that play a leading role in providing solutions to environmental challenges and enabling humanity to live within the limits offered by the planet. We thus distinguish three types of activities, across the energy and non-energy sectors. The first two are relevant to climate change specifically:

Our vision is the broad green economy: i.e. it incorporates companies that play a leading role in providing solutions to environmental challenges and enabling humanity to live within the limits offered by the planet

- **Core low-carbon energy technologies**: low-carbon and energy efficiency with strong evidence supporting the positive environmental exposure e.g. wind, solar (energy solutions in the Low Carbon Investment Registry).
- **Broad low-carbon energy technologies**: all low-carbon technologies, including the contentious ones, i.e. for which the positive environmental exposure is difficult to estimate and/or implies significant negative externalities/uncertainties and ultimately interpretations (e.g. CCS, nuclear, large hydro in non-temperate zones). In our view, these technologies need to be factored in as they will make various contributions to progress in the context of the colossal energy sector decarbonisation challenge (energy production and use make up two-thirds of total GHG emissions globally).
- **Broad green economy**: including a heterogeneous list of businesses not necessarily directly related to the energy sector, and once more, for which the environmental credentials are hard to prove e.g. support services, waste & water. Climate change adaptation solutions would fall within this category.

Chart 23: Matrix of possible "green" classifications for technologies, industries and products

Sector/Business	IEA 2DS	LCI Registry Taxonomy (adapted from CBI)	KECH Green/Ambivalent/Brown classification			KECH Core/Broad green impact universes	
			Green	Ambivalent	Brown	KECH Core Green Impact universe	KECH Broad Green Impact universe
Agriculture & Forestry							
Forestry activities	X	Specified forestry activities, timber harvesting excluded		X			Pulp & Paper owning certified forestry assets
Sustainable agriculture	X	Specified agriculture activities, peat land excluded		X		Organic food	Chemicals fertilisers, environmentally-friendly businesses (e.g. bioagriculture, precision agriculture)
Buildings							
Building energy efficiency	X	Green buildings		X		Building materials energy efficiency solutions	REITs green buildings
Appliances, lighting and equipment energy efficiency	X	Energy efficiency technology/products needed to ensure buildings meet industry performance standards		X		X	X
Energy							
Renewable power							
Solar	X	X	X			X	X
Wind	X	X	X			X	X
Large hydro in tropical regions	X	More work required		X		X	X
Bioenergy	X	X		X		X	X
Nuclear power	X			X			
Gas-fired power	X			X			X
Coal-fired power					X		
Carbon capture and storage	X	More work required		X		X	X
Smart grids	X	X	X			X	X
ICT							
ICT solutions	X	Broadband, smart grid, low carbon ICT infrastructure		X			M2M, Datacentres using renewable energy, semis
Industry							
Co-generation and DHC	X	Co/Tri generation & heating management	X			X	X
Energy storage	X		X				
Energy efficiency	X	X		X		X	Fossil fuel efficiency
Transport							
Fuel economy	X	Fuel efficient vehicles & alternative fuel vehicles		X		Hydrogen, biofuels, bioenergy, fuel cells	Auto suppliers fuel efficiency solutions
Electric vehicles	X			X			
Railway	X	All but fossil fuel transport	X			X	X
Waste & Water							
Recycling	X	Circular economy activities		X		X	X
Waste management	NA			X		X	X
Water management	NA			X		X	X
Waste to energy	NA	Waste energy capture, more work required		X		Share classified as renewables (biodegradable part)	X

Source: Kepler Cheuvreux, IEA, LCI Registry Taxonomy

Beyond pure plays and questions related to the inclusion of the themes per se, two types of situation may arise when assessing companies' exposure to the theme:

- **Transformation stories**. Energy transition among utilities is, for example, an attractive, dynamic growth story between old and new technologies and business models, and many companies may have two businesses in each, with one projected to overtake the other, e.g. Italian utility ERG has been transforming from an oil & gas company into a pure wind player, but still has limited exposure to fossil fuels (natural gas). The most proactive utilities e.g. E.ON via spin-off or ENEL via its 2050 decarbonisation plan, seem to be on the way to becoming eligible. In fact, over the long run most industries are becoming increasingly difficult to distinguish due to an underlying "greening" of business models in many ways.
- **Ambivalence**. As much as the divest-reinvest thesis (from fossil fuels to low-carbon energy solutions) does not rigorously apply, the green-brown frontier is not strictly workable as such in practice. Andritz, for instance, may be seen as a problematic company in terms of classification within the green impact universe due to its somewhat conflicting business impacts and related social concerns (e.g. exposure to controversial dam projects in emerging markets). Besides, while the IPCC expressed support for hydropower to mitigate climate change, there is no consensus on lifecycle GHG emissions from the various types of dams, especially in tropical regions (due to the decomposition of organic carbon in the reservoir). Andritz claims to produce 45% of sales from renewable energy, mainly hydro. The criterion considered by the Low Carbon Investment Taxonomy (LCIT) is nevertheless "*revenues from or to hydro projects in temperate zones*". It has been around 20% on average in the last three years. However, in 2014 it was only 15%.

Table 12: The result: Kepler Cheuvreux core green impact universe

Company	Sector	Country	Analyst	Main activities	Unit
Alternative Energy & Transport					
Alstom	Capital goods	France	William Mackie	Rail transport products, systems and services.	100 % Sales
Ansaldo STS	Capital goods	Italy	Enrico Coco	Rail and mass transport systems	100 % Sales
CAF	Capital goods	Spain	Inigo Egusquiza	Design, production, maintenance and supply of equipment for the railway industry	100 % Sales
Groupe Eurotunnel S.A.	Transport	France	David Cerdan	Operates fixed link between Great Britain and Europe.	100 % Sales
Talgo	Capital goods	Spain	Javier Campos Clavero	Pure-play and leader in the VHS (very high speed) and HS (high speed) train industry	100 % Sales
Vossloh	Capital goods	Germany	Craig Abbott	1) Rail infrastructure 2) motive power & components	100 % Sales
Biomass Resources					
Ence	Paper	Spain	Javier Campos Clavero	Production of renewable energy using forest biomass.	25% Sales
Novozymes	Pharma & biotech	Denmark	Richard Koch	Industrial enzymes. primarily the bioenergy enzymes business	67% Sales
Eco-Products & Services					
Air Liquide	Chemicals	France	Martin Roediger	Hydrogen to produce sulphur-free fuels, oxygen injection in blast furnaces, oxygen in electric arc furnace (EAF), cogeneration, industrial gas for photovoltaic sales, production of biogas, CCS.	28% Sales
Arcadis	Capital goods	Netherlands	Andre Mulder	1) Water protection; 2) efficient systems for heating, cooling, air-conditioning, storage of heat; 3) environmental services	43% Sales
Bureau Veritas S.A.	Support services	France	Patrick Jnglin, CFA	In-service inspection & verification certification	30% Sales
Eurofins Scientific SE	Support services	France	David Cerdan	Environmental testing: testing of water, air, soil, waste and other products to assess their quality and impact on health and the environment. Eurofins is also exposed to Food & feed testing and testing for pharma/biotech	20% Sales
Imtech	Capital goods	Netherlands	Andre Mulder	Technical services provider in the fields of electrical engineering, ICT and mechanical engineering.	55% Sales
Intertek Group PLC	Support services	United Kingdom	Patrick Jnglin, CFA	Related sustainability services include: 1) Health and sustainability services for Consumer Goods; 2) Environmental Sustainability Solutions; 3) Environmental and Sustainability Report Verification; 4) Biofuels Sustainability Auditing Services; 5) BIFMA level™ Sustainability Certification for Commercial Furniture; 6) Health and Environmental Sustainability Benchmark Profile; environmental certification	25% Sales
Linde	Chemicals	Germany	Martin Roediger	1) Gas-to-liquid. 2) Enhanced oil recovery (EOR) & enhanced gas recovery (EGR): energy efficiency 3) Cleaner fuels & clean coal & clean gas	45% Sales
SGS S.A.	Support services	Switzerland	Patrick Jnglin, CFA	Offers a range of inspection, testing, audit and verification services	20% Sales
Umicore	Chemicals	Belgium	Peter Olofsen	1) Recycling treats complex waste streams containing precious and other non-ferrous metals. 2) Automotive catalysts	57% Sales
Energy efficiency					
ABB	Capital goods	Switzerland	William Mackie	1) Plant process selection; 2) Optimised process control; 3) More efficient equipment; and 4) Loss recovery and/or loss reductions	50% Sales
Aixtron	Semis	Germany	Bernd Laux	Development and production of equipment for the production of compound semiconductors (mainly LEDs)	80% Sales
Blue Solutions	Capital goods	France	Pierre Boucheny	Provider of lithium-metal polymer batteries dedicated to energy storage applications	100 % Sales
Legrand	Capital goods	France	William Mackie	1) Lighting, heating and plant managements. 2) Analysis, measurement and monitoring of electrical equipment	54% Sales

Continued on next page...

The result: Kepler Cheuvreux core green impact universe ...continued

Company	Sector	Country	Analyst	Main activities	Unit
Oerlikon	Capital goods	Switzerland	Hans-Joachim Heimbuerger	1) Automotive sector (fuel efficiency), increased lifespan of materials; 2) improved energy efficiency in textiles machines; 3) wind turbines as part of Drive Systems	50% Sales
Osram Light	Capital goods	Germany	Peter Olofsen	Products, systems, solutions and services with the greatest potential for energy savings. Mainly LED	70% Sales
Pfeiffer Vacuum Technology	Capital goods	Germany	Craig Abbott	Develop, manufacture and market components and systems for vacuum generation, measurement and analysis	100 % Sales
Philips	Capital goods	Netherlands	Peter Olofsen	Lamps with lower energy consumption including LED, compact fluorescent	25% Sales
S&T	Capital goods	Germany	Baptiste de Leudeville	IT solutions in the smart-grid market	20% Sales
Saint-Gobain	Construction & materials	France	Josep Pujal	In building insulation the main products are glass wool and flat glass. To a small extent: distribution and exterior solutions.	20% Sales
Schneider Electric	Capital goods	France	William Mackie	The largest contributors to energy efficiency sales are, in decreasing order, services, critical power, building automation systems and variable speed drives. Power equipment for wind & solar projects. Charging stations for electric vehicles	46% Sales
Siemens AG	Capital goods	Germany	William Mackie	Energy efficiency as part of Infrastructure & cities BU. Rail solutions as part of its Infrastructure & cities BU. Wind equipment.	43% Sales
Wienerberger AG	Construction & materials	Austria	Stephan Trubrich, CFA	Wienerberger's innovative products and system solutions for bricks (clay blocks, roof tiles, facing bricks) help reduce energy costs and CO2 emissions	25% Sales
Zehnder Group		Switzerland	Martin Flueckiger	Energy-efficient products and system solutions for a comfortable and healthy indoor climate.	95% Sales
Zumtobel	Construction & materials	Austria	Stephan Trubrich, CFA	Professional lighting solutions, luminaires, lighting management and lighting components for indoor and outdoor application	50% Sales
Renewable Energy					
Acciona	Utilities	Spain	Jose Porta	Water (designs, builds and operates plants for drinking water and wastewater treatment, desalination and water reuse), Renewable energy generation and energy efficiency in buildings and construction	87% EBITDA
Alerion	Utilities	Italy	Claudia Introvigne	Wind energy production	100 % Sales
Andritz	Capital goods	Austria	Thomas Neuhold, CFA	Electromechanical equipment for hydropower stations (particularly turbines and generators); plants for generating energy from biomass, e.g. biomass boilers for the pulp and paper industry or plants for drying and pelleting biomass; plants for production of liquid biofuel, such as biodiesel or bioethanol (second generation); plants for converting waste products into energy sources (waste-to-power)	45% Sales
EDP Renovaveis	Utilities	Portugal	Jose Porta	Wind energy generation	100% EBITDA
ENEL Green Power	Utilities	Italy	Claudia Introvigne	Wind, hydroelectric, geothermal, solar, biomass	100 % Sales
ERG	Utilities	Italy	Claudia Introvigne	Wind generation	90% EBIT
Falck Renewables	Utilities	Italy	Claudia Introvigne	Wind energy production, waste/biomass	100 % Sales
Iberdrola	Utilities	Spain	Jose Porta	Wind energy equipment, Wind energy generation, Hydro generation	13% EBIT
IREN	Hydro	Italy	Claudia Introvigne	Water, waste and renewables	40% EBIT
Nordex	Capital goods	Germany	Douglas Lindahl	Wind turbines equipment	100 % Sales
Saeta Yield	Utilities	Spain	Jose Porta	Wind generation	100 % Sales
Verbund	Utilities	Austria	Ingo Becker, CFA	Hydropower generator	94% electricity generation

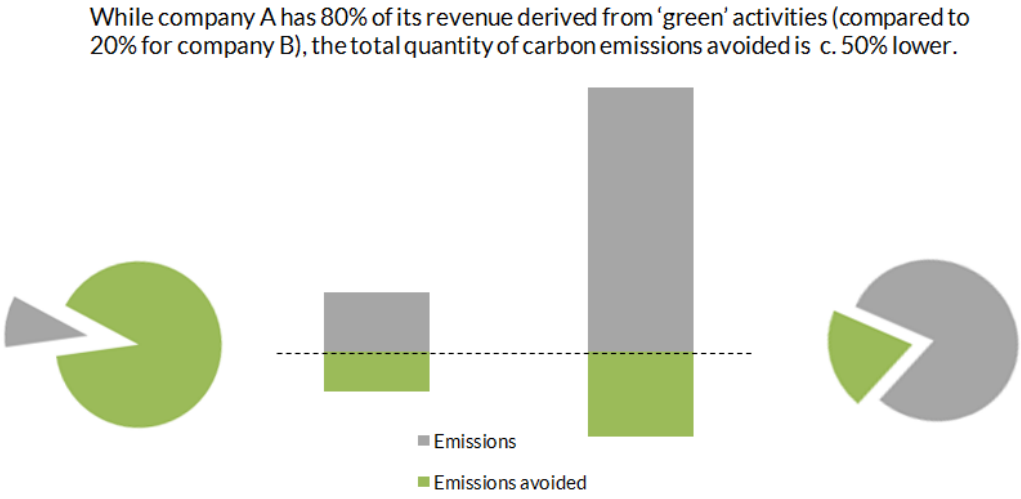
Source: Kepler Cheuvreux

Putting a carbon figure on the 'green' share: avoided emissions

'Green'/'brown' share metrics are a useful starting point to assess whether some emissions were probably avoided as a result of a product, service or project.

The aggregation of different activities into a single 'green' share or 'brown' share is disconnected from the true contribution and/or exposure, as different 'green' activities across companies may be high-contribution or low-contribution. For example, Airbus's budget for the development of solar planes, a breakthrough innovation with huge potential for GHG emissions, is USD20m, about the same as building 20km of railway in France. Similarly, displacing grid electricity with renewable energy in China will have a higher impact than doing so in France, due to the higher carbon intensity per kWh in China.

Chart 24: 'Avoided emissions' – calculating the magnitude of the contribution



Source: Kepler Cheuvreux

Emerging methodologies have attempted to quantify the magnitude of this contribution. 'Avoided emissions' are emissions that are avoided outside a company's Scope 1, 2 or 3 due to its products or services.

Emerging methodologies have attempted to quantify the magnitude of this contribution

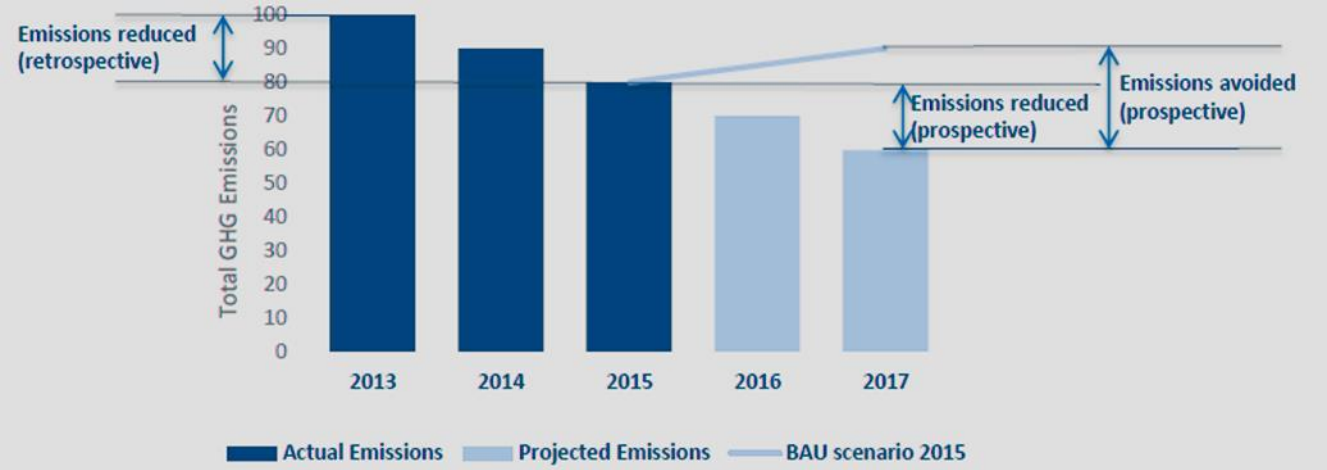
Expert track: avoided emissions – where do we draw the line?

Probably due to a lack of standard and consensus, we believe there is confusion as to what 'avoided emissions' really are. We argue that only reductions compared with a specified baseline fit within the core definition, such as avoided emissions caused by a specific product, service or project (e.g. if it is contributing to energy efficiency in another sector).

Reduction through time, due to energy-saving/energy-mix processes or procedures put in place for example, only analyses the trend of Scope 1, 2 or 3 emissions through time and does not classify as 'avoided emissions' in our view.

If the business-as-usual scenario is rising (as shown in Chart 25) while actual emissions are declining, then avoided emissions can be greater than actual emissions reduced.

Chart 25: Illustration of avoided and reduced emissions concepts using 2015 baseline year



Source: 2° Investing Initiative

In search of a standard

At the moment, standards only exist at the project level, for example the GHG Protocol and the Clean Development mechanism methodology. In fact, many of the largest global International Financial Institutions and development banks are in a process of harmonising the way in which they estimate such avoided emissions (link) for three common project types – renewable energy, energy efficiency and transportation.

These developments do not address avoided emissions at the corporate level but contain important insights that can help us start understanding the issues at stake. Industry organisations have also developed their own guidelines, in particular in the cement, information and telecommunication, power generation and asset management sectors. Corporates, such as BASF, have also started devising methodologies, based on these sector-specific standards, to calculate emissions avoided at company level.

The World Resource Institute is currently investigating the feasibility of accounting and reporting product level avoided emissions by companies and whether this can be used to drive low-carbon product innovation. The completion of the project is planned for 2017.

What are the main methodological considerations?

Methodological choices include data sources, lifetime versus annualised emissions, the choice of baseline and double counting

Emissions are usually calculated directly at corporate level, without taking into account sectors or products, but rather metrics such as fuel use and electricity consumption, except in some specific estimation methodologies. **Most categories of avoided emissions require an understanding of the product/sector breakdown, a calculation at this level and aggregation at corporate level**.

- **Data sources.** Two potential data sources to calculate avoided emissions include estimates based on activity/product/sector data and life-cycle analysis coefficients and/or averages based on disclosure.

In the context of equity or fixed income, we believe that using company disclosure is a good option for screening purposes, but may not be sufficient to inform selection or allocation decisions as few investees report avoided emissions, and when they do, the results are hardly comparable due to a lack of standards in this field.

- **Lifetime versus annualised reductions.** Lifetime emissions may be better suited in the context of illiquid investments, such as project finance or infrastructure. Annualised emissions are preferred for equity and fixed income. Regardless of the timeframe chosen, consistency is key. Challenges include the allocation over a lifetime to certain assets (motorways), the possibility of retrofitting and a lack of data.
- **Baseline.** The GHG Project Protocol defines the baseline candidate as "*alternative technologies or practices, within a specified geographic area and temporal range, which could provide the same product or service as a project activity*". This document then discusses the choice of baseline at project level (link).

Taking the current split of technologies or products available on the market is the easiest option. However, it is based on a static view that may not be an accurate representation of reality.

When accounting for avoided emissions over multiple years, what constitutes business-as-usual may change throughout the lifetime of the product/service/ project. One may want to consider a dynamic baseline, for example in the context of project finance or green bonds.

Emission reduction at the margin may differ from industry averages and methodologies that take this into account may be an interesting option, depending on the aim of the analysis and required level of sophistication. It may not be needed for the high-level screening of an equity portfolio but it may be useful in accounting for the avoided emissions for a specific project, especially for activities in energy efficiency and renewables. Certain life-cycle analysis databases, such as EcoInvent (link), have an average marginal coefficient.

Emission reduction at the margin may differ from industry averages and methodologies that take this into account may be an interesting option

- **Double counting.** When the savings are aggregated at portfolio level, the question of double counting the benefits may arise. The Carbone 4 and Mirova methodology uses value-add in order to allocate induced and avoided emissions between multiple components and an end-product, whose use avoids emissions. Value-add can be calculated at company or sector level.

Expert track: dynamic baselines

Let's consider a new energy-efficient heating, ventilating and air-conditioning (HVAC) system. Assuming that:

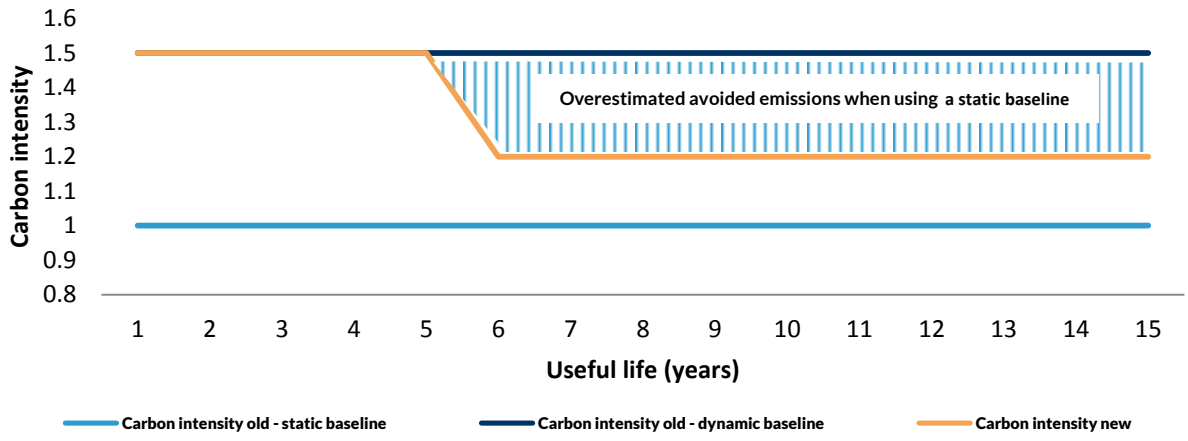
- The new equipment has a carbon intensity of 1kg per year.
- The old equipment's carbon intensity is 1.5kg per year with a lifetime of 15 years.

A static baseline will calculate the avoided emissions as follows: New equipment lifetime * (old equipment efficiency – new equipment efficiency) = 15 * (1.5-1) = 7.5kg per product over the full lifetime.

However, it is likely that the old equipment will be replaced by more energy-efficient equipment (as business-as-usual baseline) sometimes during the life time of the new equipment. In reality, the old equipment has five years of useful life remaining at which point it would have been replaced by new equipment with a carbon intensity of 1.2kg per year.

A dynamic baseline calculates the avoided emissions as follows: Useful remaining life of the old equipment * (old equipment efficiency – new equipment efficiency) + remaining useful life of the new equipment * (new business-as-usual equipment – new equipment efficiency) = 5 * (1.5 – 1) + 10 (1.5 – 1.2) = 5.5kg per product over full life time or 2.5kg less than the static baseline.

Chart 26: Dynamic baselines visualised



Source: Kepler Cheuvreux, 2° Investing Initiative

In practice...

Avoided emissions are a concept mostly used in project finance, mainly by development banks. Very few data providers or asset managers have attempted to use this method systematically at portfolio level (but the majority of data providers are able to provide this type of metric on demand, at stock level). When they do, it is usually part of other assessment metrics.

In practice, very few data providers or asset managers have attempted to use this method systematically at portfolio level

Table 13: Use of the avoided emissions concept in methodologies (not exhaustive)

Investor	Carbon footprint	Avoided emissions	Other metrics	Output	Comment
Mirova/ Carbone 4 (link)	Scope 1, 2, and 3 where relevant. Methodology to avoid double counting. Estimates data gaps based on sector intensity. Normalises by enterprise value to avoid double counting between debt and equity	Different methodology for each high-stake sector, based on the specific challenge in the context of the energy and climate transition. - Energy sectors (production, processing, transport and distribution of fossil fuels, electricity production, electricity transport and distribution): comparison of the carbon intensity of electricity produced with a reference scenario (world electricity mix in IEA 2DS scenario at 2025). - Suppliers of equipment with a low carbon potential (aimed at energy, transport, building, industry and IT sectors): emissions avoided thanks to efficient products sold during the year, taking into account the lifetime of products and compared with the products that will be replaced. - Carbon-intensive sectors (heavy industry, real estate, transport operators and transport infrastructure, forest and paper, agriculture and agribusiness): decrease in the GHG-intensity of the company for the past five years and in some cases comparison with a reference scenario.	Additional qualitative indicators include the company's tendency to contribute to the energy transition (based on capex and R&D) and transparency/reporting quality	At company level: - Induced and avoided carbon emissions - Carbon impact ratio (avoided/induced) - Forward-looking qualitative rating - Transparency and quality of reporting - Global assessment of the contribution to climate change At equity portfolio level: - Charts of sector distribution of induced and avoided emissions - Total induced and avoided emissions at portfolio level - Distribution of qualitative ratings in each sector and in the portfolio	One of the few methods that includes 'avoided emissions' across a large universe of listed companies. Includes more qualitative, forward-looking elements in the scoring methodology. Main limitation is the use of different baselines which decreases cross-sector comparability and different timeline (product lifecycle avoided emissions vs. annual corporate emissions). **Overall, it is important to note that the end result is a score, not a net footprint. In that perspective, companies within a sector may be compared based on their ratio of induced/avoided emissions but it is best to compare companies within different sectors using the total score.**
ImpaxAM (link)	Disclosure where available and engagement with companies. Includes Scope 1 and 2. Where available (six companies), other indirect Scope 3 emissions were included. When no data, estimates based on relevant peer groups of disclosing companies, taking into account geographical mix where possible. Conservative: highest intensity of the peer group assigned.	If the company discloses data, include it. If not, where possible, estimate the number of units sold (based on revenue per product category and average price per unit of product) and environmental benefit per unit of product using best available industry estimates. If revenue per product category not available, do not assign any avoided emissions.	Metrics include: - Net impact from GHG emitted minus GHG avoided - Renewable energy: positive impact from renewable energy generated (MWh) - Water: positive impact from water treated/ water saved/ clean water provided (litres) - Materials: positive impact from materials recovered/ waste treated (tonnes)	Quantitative results for the four metrics identified. Heat map at company level identifying negative, positive and secondary positive impact	**Innovative approach which goes beyond traditional footprint by including Scope 3 and avoided emissions. Process, methodology and data assured by EY. Good for a secondary layer of screening (leading to engagement) and communication purposes. Results may need to be refined for further use.** One of the main hurdles is the potential lack of comparability, especially in reported Scope 3 and avoided emissions.

Continued on next page…

Use of the avoided emissions concept in methodologies (not exhaustive)…continued

Investor	Carbon footprint	Avoided emissions	Other metrics	Output	Comment
Sycomore AM (link)	Where relevant, based on life-cycle analysis studies. Looks at the most impacting life cycle stage and how a product/service may help to reduce the footprint.	Based on life-cycle analysis studies, using the average performance of market solutions as a baseline using the same functional unit. Dynamic baseline.	Analyses two to three environmental impacts specific to each sector, including climate change.	Used to pick stocks for the Sycomore Eco Solutions fund. Includes exclusionary filters for certain sectors. Results are expressed as a % difference with average market solution.	**Innovative approach which appears to rely on strong methodological grounds**. Used to calculate the magnitude of the contribution to the energy and ecological transition, as a % of turnover, in order to screen in companies that contribute directly and more meaningfully (vs. indirectly and partially) to address environmental issues and therefore demonstrate a higher degree of alignment with the transition."
ASN BANK/ Ecofys (Link)	Disclosure where available, Scope 1, 2, and first tier-indirect for certain asset classes (listed equity). When no data, estimated. Includes ASN Bank footprint, and footprint of investments in equity and debt investments.	Avoided emissions from investments in Green Bonds and project investments in emission reductions (renewable energy or energy saving measures). Yearly avoided emissions, calculated by taking the proportional share of the total project value financed by ASN Bank. Uses business-as-usual baseline scenario (based on current electricity mix), not marginal.		Profit and Loss over Scope 1, 2, and 3 of the bank, including avoided emissions, on an annual basis. Aims to become carbon neutral by 2030 (i.e. emissions induced = emissions avoided).	**One innovative way to use the avoided emissions metric**. Avoided emissions only apply to project finance and green bonds (not listed equity). Looks at annual emissions.

Source: Mirova/ Carbone 4, Impax AM, Sycomore AM, ASN Bank, Kepler Cheuvreux

A step closer to the assessment of exposure and risk?

Information on green-brown current and future exposure is a useful starting point in the systematic and bottom-up evaluation of carbon risk. These methods go further than shadow pricing or scoring (as discussed in the previous section) as they build on traditional financial risk analysis to include the carbon component.

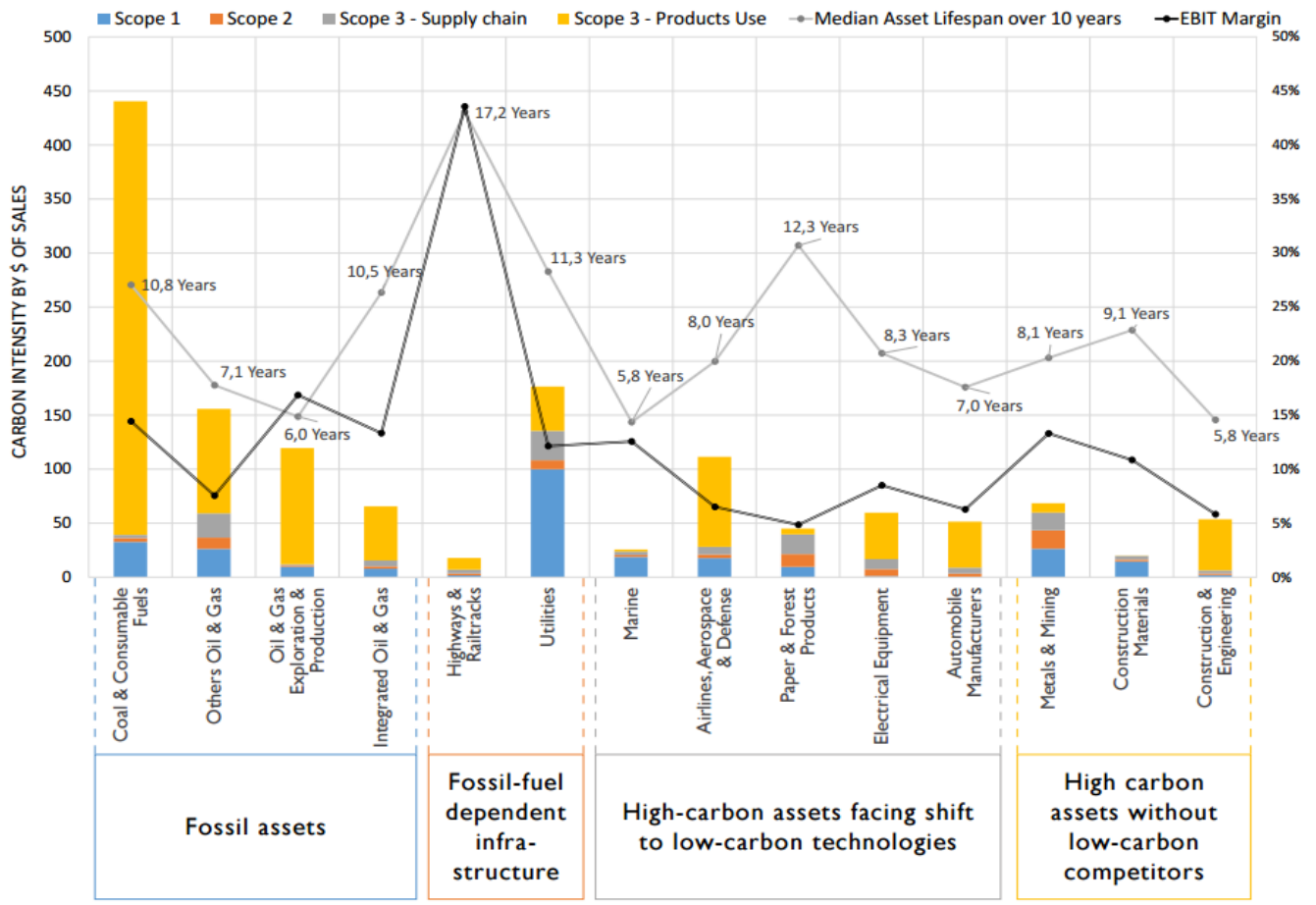
One can distinguish between carbon (linked to the energy and carbon intensity of assets) and climate risk (linked to physical risks, e.g. extreme weather events). Most studies analyse the carbon and climate risk separately, with climate risk being picked up primarily by insurance companies. Here, we focus primarily on carbon risk as it is linked to the carbon intensity of assets, but later in this report we discuss the Mercer methodology, which looks at both carbon and climate risk.

Asset-level risk: an active field of research

The concept and body of work around stranded assets is a well-known concept and body-of-work at asset level, focusing on the 'brown' share that may no longer be viable in the future due to economic or regulatory stranding. The Carbon Tracker Initiative has been very active in this area, with a specific focus on energy sectors, with many organisations applying the concept in different ways, including in other sectors such as agriculture.

Green-brown metrics need to be analysed together with other metrics. For example, risks are particularly material for assets with long time horizons. A production/ innovation cycle of three years (e.g. in the telecommunications sector related to cell phones) allows for a relatively flexible and rapid adaptation. Disruption is particularly damaging to long-term assets that cannot adapt. Unfortunately, climate-related infrastructure generally has a lifetime of 10, 20, 30, 40 years or more.

Chart 27: Example of carbon, financial and asset data overlaid to get a sense of carbon risk



Source: WRI & UNEP FI (link)

At **asset level, risk management and investment decisions may come first in the form of impairment tests for the most exposed assets and sectors**: for example, the impact of climate policies on energy-intensive assets, via scenarios around energy demand, price and carbon price allow for a definition of carbon supply cost curves, as developed by the Carbon Tracker Initiative (link).

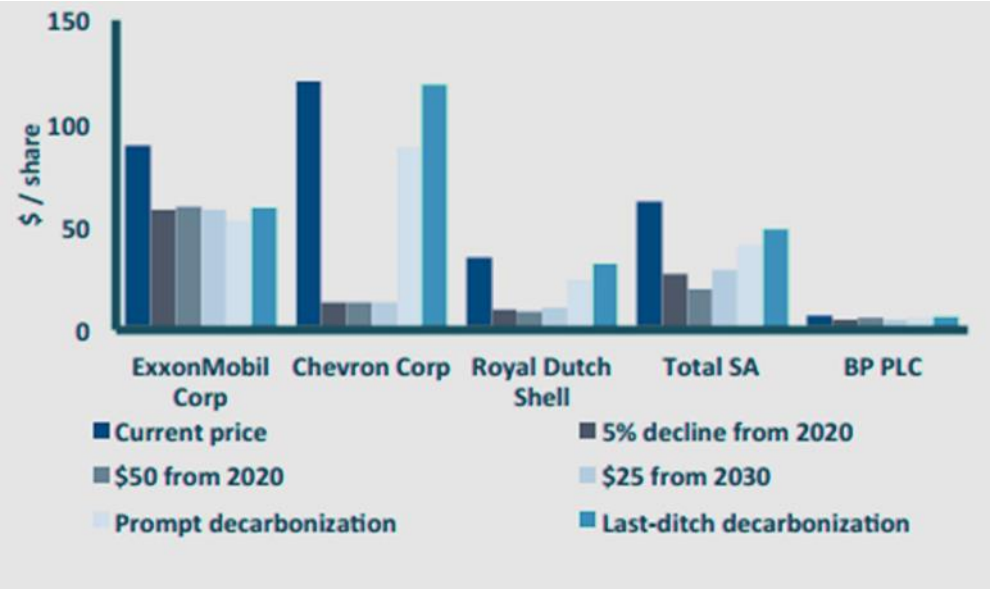
Investee-level risk: building on asset-risk

The work of UNEP-FI and WRI distinguishes between 'carbon asset risk' and 'operator carbon risk'. Economic impairment of physical assets is likely to impact the valuation of investees that own or operate these assets. The risk at asset level may be passed on to the 'operator' of the asset and either be reinforced or mitigated by the 'operator's' policies and business models. Additional risks may also directly impact investees through regulatory, reputational or market drivers. Examples of research include:

- **Equity:** the impact of carbon risks can be assessed through a number of different indicators. For example, Kepler Cheuvreux used the IEA 2˚scenario to estimate the potential lost revenues of oil and gas companies. Bloomberg offers an online valuation tool for fossil fuel companies.

- **Credit:** Credit ratings agencies such as S&P and Moody's have also published a first series of papers on the potential implications of carbon risks on corporate credit ratings. The Global Footprint Network has started to work on stranded asset risk at national level, via a set of macro indicators that include physical climate risk. Beyond Ratings is also developing models to look at energy risk in **sovereign ratings**.

Chart 28: Changes of current share price as a result of stranded assets scenario



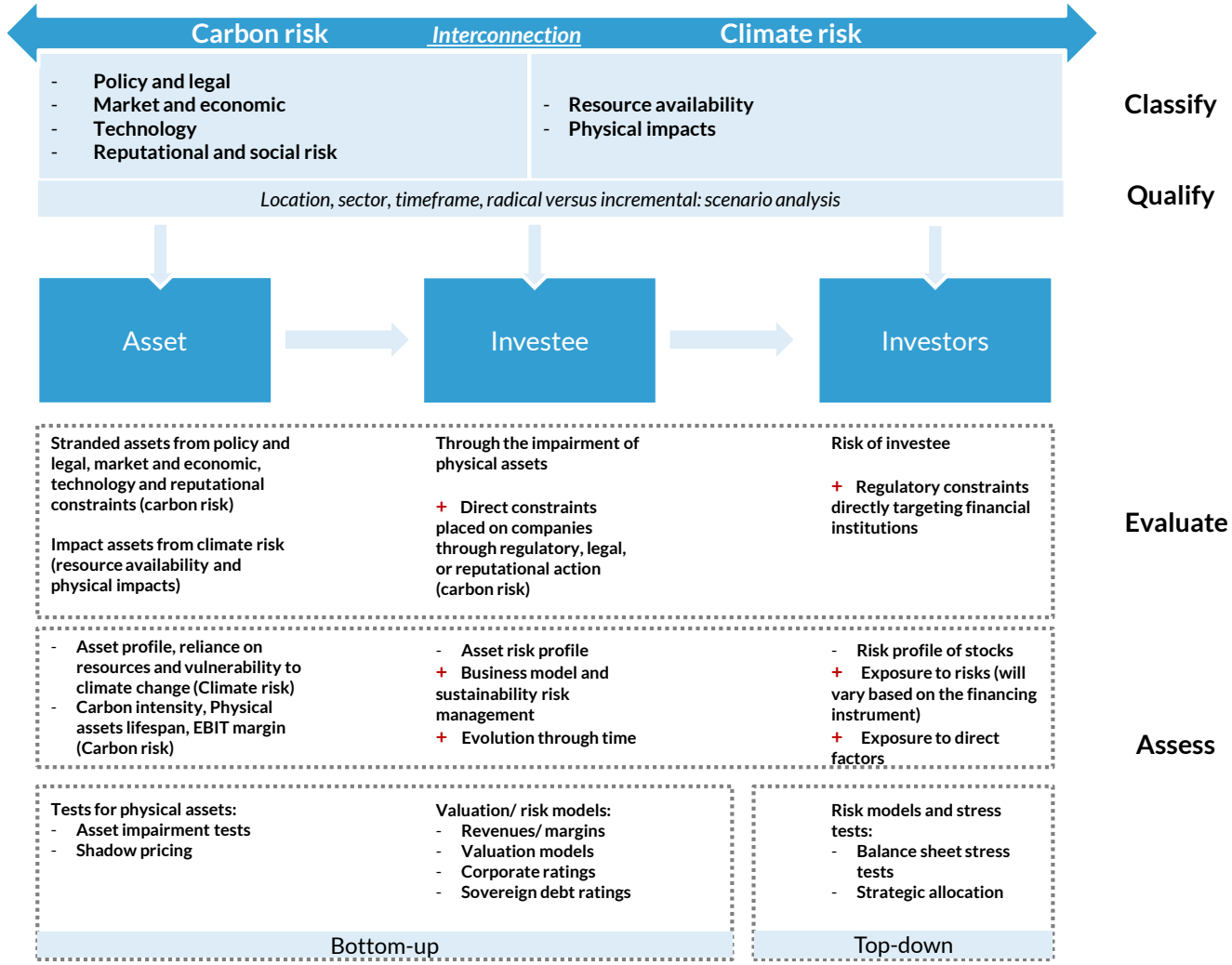
Source: 2° Investing Initiative, BNEF 2014, Bloomberg

Kepler Cheuvreux will be launching an interactive platform soon that will allow investors to understand ESG risk at investee level, including risk on climate change factors. Information on how risk is managed and/or potentially passed through to investors will be captured through questions focusing on the company's strategy and business model, as well as commentaries on external risk factors.

<u>Portfolio-level risk: a research field in its infancy</u>

Unmanaged residual risk may further build up at portfolio level. The type of investment relationship (or location in the 'capital stack' in UNEP-FI and WRI's framework) may enhance or mitigate the risk. Financial institutions also face regulatory constraints targeting them directly. Methodologies include balance sheet stress tests and analysis of the impact of carbon risk on strategic asset allocation.

Chart 29: Assessing risk at multiple levels



Source: Based on WRI/UNEP FI

Comparing performance: benchmarks

While carbon footprint, green-brown and avoided emissions metrics can, to a certain extent, *indirectly* provide information on the contribution to the transition to a 2° world, they lack benchmarks *directly* reflecting the end goal.

If you only have five minutes

Using existing indexes as benchmarks, a useful start but…

The climate contribution of the majority of carbon footprints is measured relative to existing indexes using benchmarks at portfolio level (comparing with indexes such as MSCI ACWI, FTSE 500, etc.). This is useful to get an understanding of contribution or exposure compared with the 'status quo' but may not be a good indicator, as existing indexes are biased towards energy-intensive industries.

… there is a need for metrics that relate to the end goal

A new set of metrics is being developed to tackle these limitations – 2° technology benchmarks and science-based targets. Their starting point is the need to limit the temperature rise to 2°C. These methods then suggest trajectories and compare them with business-as-usual pathways.

Deriving appropriate benchmarks is likely to take centre stage as some investors' mandates involve contributing to public goals, including climate mitigation (2° Investing Initiative/UNEP/WRI 2015). The new French regulation has introduced an innovative reporting approach that essentially requires investors to disclose (on a "comply or explain" basis) how their portfolio selection meets a 2° pathway.

At company level: science-based targets

Science-based target methodologies have been developed by a coalition of academics and NGOs in an attempt to quantify the "fair share" of emissions that can theoretically be allowed at company level in order to comply with the global goal of a 2°C temperature increase.

While this type of analysis is primarily used to set or assess targets at investee level, it can in theory be aggregated at portfolio level and used to assess alignment with the 2° goal. One limitation is the lack of forward-looking greenhouse gas emissions data reported by companies; this makes interpretation difficult and this type of analysis is best used together with other metrics, such as forward-looking 'green' metrics.

2˚ benchmark at portfolio level

2° benchmarks are also being developed at portfolio level by a consortium led by the 2° Investing Initiative and funded by the European Commission. The underlying idea is the same as the one behind the science-based targets, but 1) the analysis is done at portfolio-level and 2) it relies on green-brown exposure data rather than greenhouse gas data to assess the alignment or misalignment of a portfolio with the 2˚ trajectory. While this method is meant to be applied at portfolio level, it relies on asset and investee-level data.

While carbon footprint, green-brown and avoided emissions metrics can, to a certain extent, indirectly provide information on the contribution to the transition to a 2° world, they lack benchmarks directly reflecting the end goal

A key question is whether such top-down approaches/targets, which are by definition highly prescriptive technology-wise, can drive investment allocation and are compliant with asset owners' fiduciary duty. This is why this approach is best to assess misalignment rather than fix it. Future work will include testing what this means for companies and their financial performance.

What can you use it for?

Best for:

- Comparing and communicating performance.
- Understanding the underlying reason for differences (sector allocation, misaligned targets at investee level and misaligned technology exposure at investee level).
- Engagement on technology mix.

Not so good for:

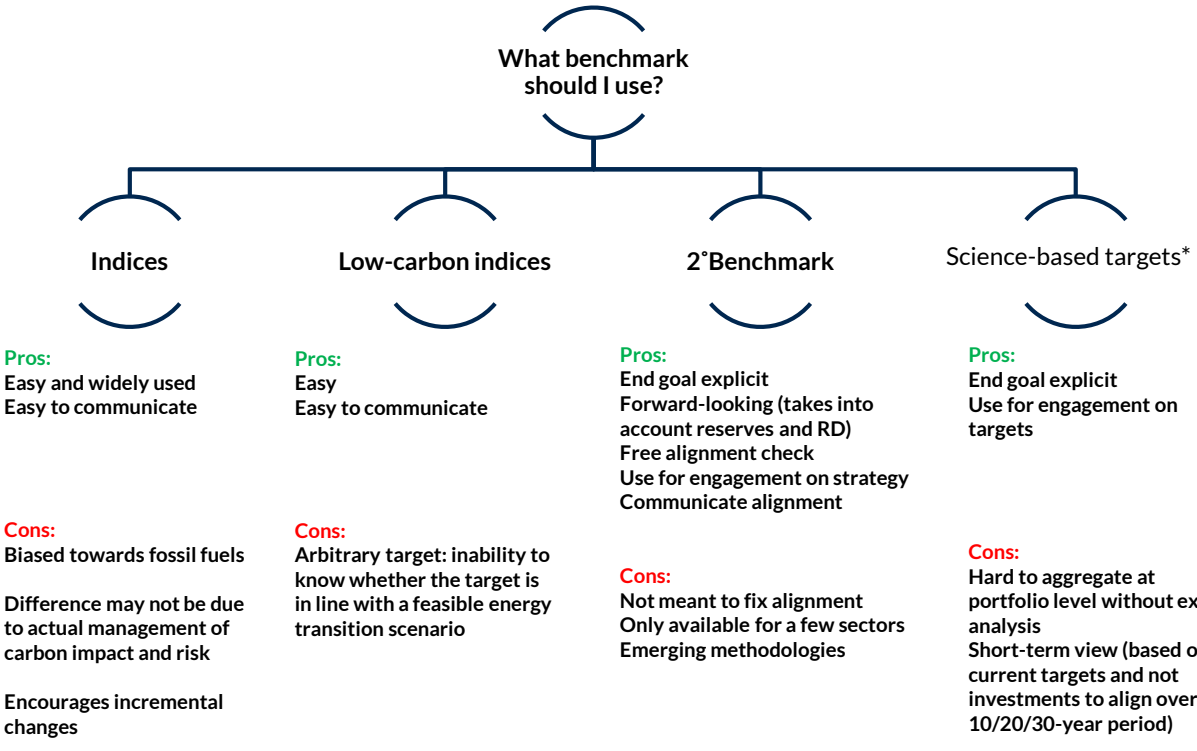
- Understanding the alignment with dynamic baseline in the case of market benchmarks.
- Taking action to fix the misalignment in the case of dynamic baseline.

Improvements needed:

- Better forward-looking data at asset and investee level.

Better understanding of the financial consequences of fixing alignment.

Chart 30: Pros and cons of each benchmark



** science-based targets were designed to set targets at investee-level but might indirectly be used as benchmarks*

Source: Kepler Cheuvreux, 2°Investing Initiative

Fasten your seatbelt

In this section, we answer the following questions:

Index-based benchmarks: what do they really measure?

Most managers benchmark their fund against a stock index to assess the relative climate change performance of their portfolio compared to a diversified benchmark. In so doing, they use the index as a 'baseline' scenario. These indexes are widely used, but represent a static view of the world and as such can be useful to measure incremental change.

2° Investing Initiative analysis shows that this approach may be limited, for two reasons:

1. The sector exposure of most stock indices used as benchmarks (MSCI World, FTSE, DJ, Stoxx, S&P, etc.) is biased towards fossil fuels compared with the real economy.
2. The restriction of the investment universe to large caps and the reproduction of the benchmark's industry exposure may skew the comparison when expressed in USDm invested.

Most investors publish carbon footprints that are lower, sometimes significantly so, than their benchmarks, with relatively higher holdings in less carbon-intensive sectors and/or stocks logically cited as the main reason. This raises questions about the actual relative importance of sector bias versus stock selection (picking lower-carbon stocks within specific sectors or peer groups).

We believe that a better variable consists in calculating the trend through time, when care is taken to hold constant certain variables that may create noise.

While this represents a more 'aspirational' benchmark compared with the status quo, a big disadvantage of these approaches is the inability to know whether the target is in line with a feasible energy transition scenario

Expert track: keeping the ownership metric constant

Comparison may be skewed due to the formula used to calculate ownership of emissions (e.g. USD investment/ issuer's full market cap in the case of equity): while the amount invested may not change, the overall market capitalisation and value of investment will vary. In order to control for market capitalisation fluctuation and allow for time comparison, we recommend keeping the **ownership metric constant through time.**

Table 14:The effect of market capitalisation

		USDm invested	Market capitalisation (USDm)	Carbon emissions (t C02e)	Ownership	Carbon emissions attributed to the portfolio
Year 1	Company A	10	30	10,000	0.33	3,333
	Company B	1	15	30,000	0.07	2,000
					Total Year 1	5,333
Year 2	Company A	10	33	10,000	0.30	3,030
	Company B	1	16	30,000	0.06	1,875
					Total Year 2	4,905

Source: Kepler Cheuvreux

In this example, the market capitalisation of both companies increased between year 1 and year 2, leading to a decrease in the ownership metric, calculated as USDm invested/ market capitalisation (USDm). This leads to a decrease in carbon emissions attributed to the portfolio, even though the actual carbon emissions did not decrease, hence the need to keep the ownership metric constant.

Another option consists in using a low carbon index as the benchmark: the Climate Policy Initiative distinguishes between three main types: exclusionary, non-exclusionary and thematic (link). While this represents a more 'aspirational' benchmark compared with the status quo, a big disadvantage of these approaches is the inability to know whether the target is in line with a feasible energy transition scenario.

While this represents a more 'aspirational' benchmark compared with the status quo, a big disadvantage of these approaches is the inability to know whether the target is in line with a feasible energy transition scenario

Table 15: ESG Index type

ESG Index Type	Description	Examples
Exclusionary	Excludes fossil fuel companies, or particular subsectors like coal or tar sands, from index holdings; often referred to as divestment indexes	Fossil Free Indexes US; MSCI Global Fossil Fuels Exclusion Indexes; FTSE Group, Blackrock, and NRDC ex-fossil fuels index series
Non-Exclusionary	Does not exclude fossil fuels, but often overweights high-ESG performers and underweights low-ESG performers	MSCI ACWI Low Carbon Target Index; STOXX Global ESG Leaders; SXI Switzerland Sustainability 25 Index; iShares MSCI ACWI Low Carbon Target ETF
Thematic	Emphasises economic, social, environmental, and other trends to inform investment strategies. Often emphasises investment in companies focused on climate change mitigation and adaptation	MSCI Global Climate Index; S&P/TSX Energy and Clen Technology Index; MSCI Global Environment Index

Source: Climate Policy Initiative

Science-based targets: an approach at investee level…

Science-based target methodologies have been developed by a coalition of academics and NGOs in an attempt to quantify the "fair share" of emissions that can theoretically be allowed at company level in order to comply with the global goal of a 2°C temperature increase.

The science-based metrics approach comes with various methodological options (link) whose main benefit, in our view, is to drive a new dynamic in climate performance measurement by linking it to tangible macroeconomic challenges, thereby creating a holistic low-carbon eco-system. For example:

- The Sectoral Decarbonisation Approach (SDA) initiative by Ecofys for CDP, WWF and the GHG Protocol, aims at informing the setting of carbon-reduction targets in line with climate science at company level. Indirectly, it can be used to assess whether already set and disclosed targets are in line with the 2° trajectory.
- As part of the recent Business Action for low Carbon Transition Initiative, CDP and ADEME are collaborating to develop a rating based on verified information and using a sector-specific methodology, which assesses to what degree companies are taking steps towards a low-carbon economy. This will cover three sectors - power, auto-manufacturers and retail – which represent different sets of issues pertaining to: complex supply chains, complex value chains, mitigation issues, agricultural emissions, complex regulatory environment. The project is to start in December 2015 and is planned to be completed by December 2016; it is open to other participants, including partners, companies, investors and other stakeholders.

Not all science-based metric methodologies use climate scenarios. When they do (such as the Sectoral Decarbonisation Approach), typical analysis steps include:

- From the IEA pathway (or other available pathways), derive the rate of decarbonisation needed at sector level in order to achieve the 2˚ target.
- Apply it at company level to derive appropriate targets or check whether the disclosed targets are in line with the 2˚ trajectory.

… that might be applicable at portfolio level…

Existing research provides us with an annual rate of improvement in absolute emissions of approximately 1.5% globally and across sectors (IEA 2015, absolute emissions needed for a 2˚ Scenario), still well above the average rate of decarbonisation of 0.8% a year since 2000, in order to avoid any emissions gap with the 2°C target.

Such a decarbonisation rate should also take geographical exposure into account since the IPCC recommends a global effort for the period 2012-50 of 75% for OECD countries and only 48% for non-OECD countries, reflecting the logic of differentiated responsibility.

Table 16:Absolute emissions reduction rates for a world at 2˚

	Direct CO2 emissions (Mt CO2)	Industry	Buildings, agriculture, fishing, non-specified other	Transport	Power	Other transformation	Total
World	Compounded	-21%	-34%	-43%	-89%	-94%	-58%
	Annual	-0.5%	-0.9%	-1.1%	-2.3%	-2.5%	-1.5%
OECD	Compounded	-52%	-50%	-67%	-96%	-100%	-75%
	Annual	-1%	-1%	-2%	-3%	-3%	-2%
Non-OECD	Compounded	-11%	-18%	-14%	-84%	-92%	-48%
	Annual	0%	0%	0%	-2%	-2%	-1%
Asean	Compounded	6%	15%	-26%	-30%	-100%	-23%
	Annual	0%	0%	-1%	-1%	-3%	-1%
Brazil	Compounded	16%	-8%	-47%	-96%	-100%	-34%
	Annual	0%	0%	-1%	-3%	-3%	-1%
China	Compounded	-28%	-41%	2%	-89%	-100%	-58%
	Annual	-1%	-1%	0%	-2%	-3%	-2%
EU	Compounded	-52%	-54%	-62%	-95%	-100%	-72%
	Annual	-1%	-1%	-2%	-2%	-3%	-2%
India	Compounded	64%	7%	110%	-85%	-100%	-14%
	Annual	2%	0%	3%	-2%	-3%	0%
Mexico	Compounded	9%	-37%	-46%	-99%	-100%	-59%
	Annual	0%	-1%	-1%	-3%	-3%	-2%
Russia	Compounded	-40%	-37%	-52%	-95%	-100%	-77%
	Annual	-1%	-1%	-1%	-2%	-3%	-2%
South Africa	Compounded	-28%	-45%	-39%	-96%	-100%	-76%
	Annual	-1%	-1%	-1%	-3%	-3%	-2%
North America	Compounded	-56%	-45%	-73%	-96%	-100%	-80%
	Annual	-1%	-1%	-2%	-3%	-3%	-2%

Source: IEA 2015

Thus, this approach obviously requires the international footprint of companies to be identified: the good news is that most listed companies report on their exposure in both developed and developing countries. However, the implementation of country-by-country GHG reporting (as would be required to match companies to global decarbonisation scenarios) remains well below investor expectations, as seen previously in the report.

An interesting question is whether such targets at company level can inform the alignment of an investor at portfolio level (assuming that targets existed or could be defined for all companies within the portfolio). For instance, theoretically an investor could aggregate emission reduction targets at sector level, based on a selected ownership metric, and compare the aggregated target against the sector's decarbonisation pathway.

Performing such aggregation has not been applied meaningfully in the market to date and is easier said than done, since it would have to integrate a number of additional components, notably asset-class-specific benchmarks and the introduction of portfolio weighting. Furthermore, and perhaps most importantly, this metric only captures the reduction in "brown" but not the growth of low carbon technologies needed to achieve a decarbonisation scenario (see next section).

For these reasons, disclosing the annual reduction of a portfolio carbon footprint against this macro annual average rate of decarbonisation may be insufficient to measure the true 2° alignment of the portfolio. However, additional methodological development in this field may yield further insight.

…and best used together with other metrics

There are inherent limitations in using carbon data and targets in order to assess the alignment with a trajectory, due to the static nature of such data.

- Targets usually do not inform on current R&D that will determine future technology exposure, and may be set using a multitude of methods not necessarily linked to a holistic assessment of future technological feasibility and associated emissions.
- Companies report on targets over the short term, from 5 to 10 years. It is thus necessary to make assumptions on future target levels, either by extrapolating from current levels or, when targets are not available, using past carbon reduction intensity as a proxy for future reductions. This introduces a high-level of uncertainty as it does not take into account feasibility. Targets are often set based on short-term predictions, such as the availability of least-cost measures to achieve reductions.

We believe that this type of analysis is best completed with other data, in particular current and future technology exposure, at the company, sector and portfolio level

We believe that this type of analysis is best completed with other data, in particular current and future technology exposure, at the company, sector and portfolio level. Such data are more closely linked with a company's core business, are often available at asset (rather than aggregate company) level, and can incorporate both "brown" and "green" technologies.

The 2˚ benchmark: a technology-based pathway

Interesting complementary methodologies are emerging, using a technology roadmap rather than a carbon emission reduction pathway to give investors guidance and guidelines for complying with the 2° objective.

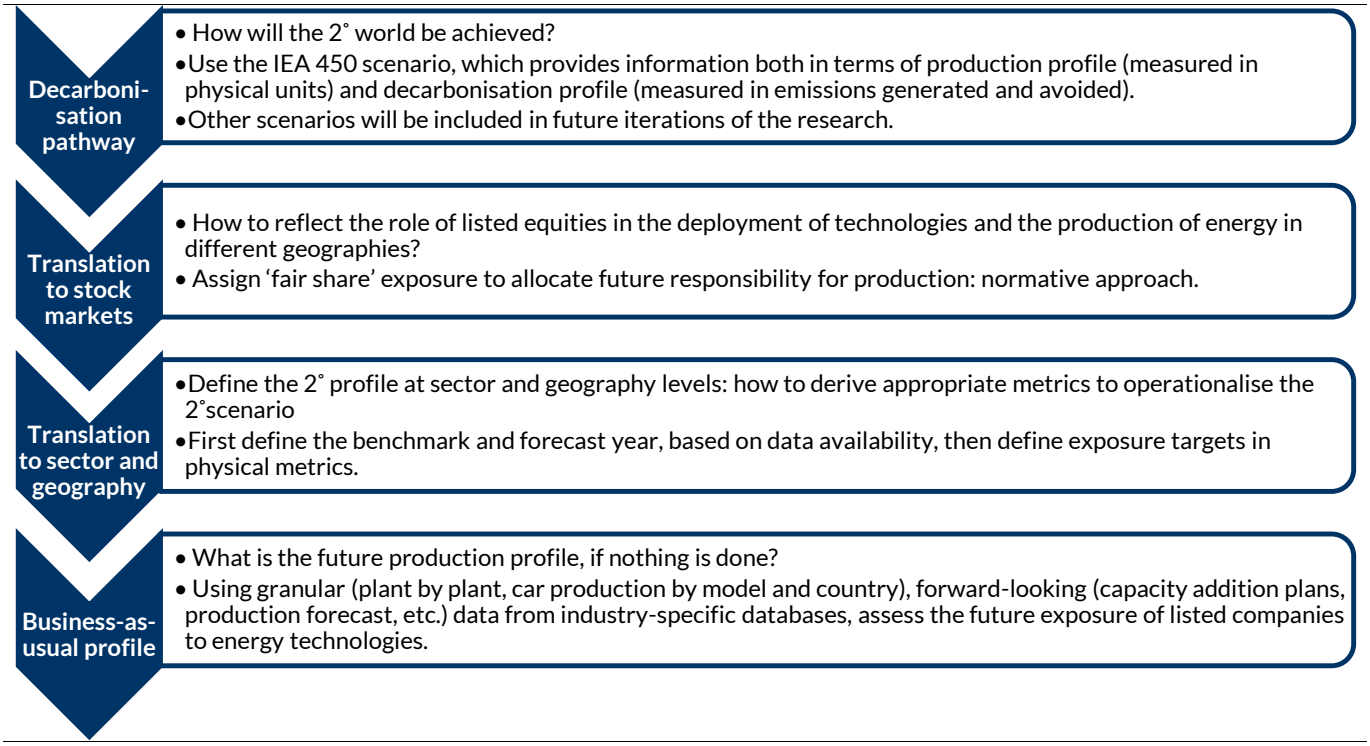
The 'Sustainable Energy Investments' research project led by the 2° Investing Initiative and supported by the European Commission (Kepler Cheuvreux being a member of the research coalition) intends to reconcile the investment roadmaps of the climate-energy scenarios such as the IEA ones together with an investor capital and sector allocation.

Such an approach could potentially avoid the use of any GHG emissions metrics since it directly maps the technology roadmap of the macro scenario with the investor's medium-term exposure, embedding both existing and future capex.

The research defines exposure targets to both solutions and climate problems at the technology level, aligned with a 2° degree world. The 'actual' portfolio exposure is then compared with the '2° portfolio' (a representative diversified equity portfolio in a market aligned with a feasible decarbonisation pathway) in order to identify over- and underexposure gaps at sector level.

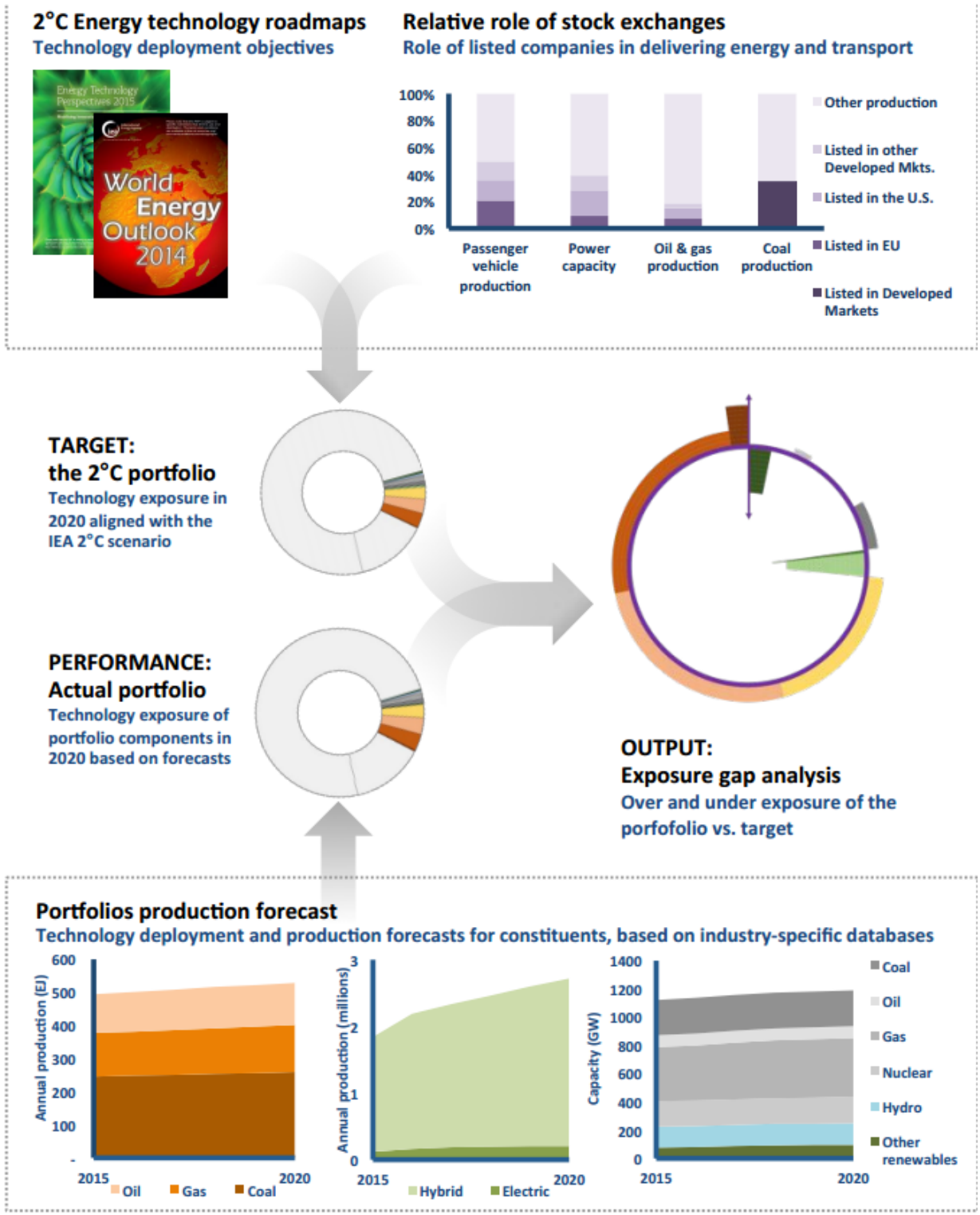
The research defines exposure targets to both solutions and climate problems at the technology level, aligned with a 2° world

Chart 31: Methodological steps



Source: 2° Investing Initiative

Chart 32: How does it work?



Source: SEI Metrics Consortium

Main limitations

Limitations include data availability, allocation to asset classes, mapping and multiple visions of the future

- **Availability only for key technologies.** Climate scenarios (e.g. IEA Energy Technology Perspectives, World Energy Outlook) set targets (production, investments, carbon intensity) for only about a dozen technologies and activities, which cover only about a third to a quarter of the listed equity universe, representing 70-80% of global GHG emissions.
- **Difficulty of isolating the specific contribution of an asset class.** Climate scenarios describe the breakdown of technologies at regional or global scale. To translate that into asset classes, the relative roles of both economic actors (listed and non-listed companies, governments) and the role of financing channels (equity, debt, self-financing) have to be assessed. While a technical challenge, simple averaging models can be used to 'translate' economic indicators into indictors by asset class.
- **The question of picking winners.** By default, a climate scenario associated with specific GHG emissions pathways reflects one vision of the future, similar to the argument against 'picking winners' in innovation and industrial policies. Any single scenario is not necessarily aligned with all stakeholders and policy goals. Two options to deal with this issue are conceivable: using several scenarios and letting investors choose, or creating a system of equivalence (e.g. exposure to low-carbon technologies A and B can be deemed equivalent since they deliver similar emission reductions).

Note that the two last limitations also apply to science-based targets: 1) if science-based metrics were aggregated at portfolio level, asset allocation would have to be performed, with the difficulties noted above; and 2) science-based metrics also rely on climate scenarios.

Table 17: Pros and cons of each methods

	2° Benchmark	Science-based targets
Main research question and level of analysis	What is the technology exposure gap at sector-level to be aligned with a 2° degree world?	What should companies' emissions target be to be aligned with a 2° degree world?
	Con: Inherently prescribes exposure to certain categories of technologies (technology exposure targets) and certain burden sharing between sectors' and geographies' carbon budget, as well as asset classes. Testing for different technology mix is a potential solution.	**Pro**: A carbon metrics indicator is less prescriptive than an energy and technology indicator. It allows for a diversity of approaches to achieve to 2° goal. Note that the emission scenarios are themselves built on the same source as the 2° benchmark (IEA 450 trajectory) which takes into account technology availability for example.
	Pro: preserves diversification principle – not all companies have to be aligned.	**Con**: difficult to aggregate at a portfolio level. Would have to integrate a number of additional components to operate at portfolio level, notably asset class specific benchmarks and the introduction of portfolio weighting.
Choice of pathway	Based on IEA 450 scenarios which imply a number of technological options that can require a degree of cautiousness (e.g. CCS representing half of the emissions reductions expected through energy efficiency creates a significant risk to the whole model, in our view).	
	Con: Forecast year is contingent on data availability (for business-as-usual growth in technology). Use 2020 for utilities and automotive and 2040 for fossil fuels. While short term data is more certain, most scenarios slow decarbonisation at first while increasing speed over the 20-40 year timeframe. Shorter term analysis may miss this aspect of the pathway.	**Pro**: pathways available until 2050. Careful: translating the 100 or 40 year 2°C pathway into a reasonable medium-term operational view of 3 to 5 years may lead to a risk of delaying action on the reductions, since the alignment may imply a very modest effort for a number of sectors (e.g. O&G efforts being delayed to post 2020).
	Pro: at the moment, only applies to homogeneous sectors. Focus on the convergence between business-as-usual scenarios with 2 degree technology pathway: it thus takes into account previous efforts at a company and sector-level and favours leaders.	**Con**: In heterogeneous sectors, introducing a baseline year (2010 in most cases) creates discrimination, similar to that observed in grandfathering bias of the EU- ETS. This is due to the use of the compression method, where every company is to decrease its emissions intensity regardless of previous efforts (thus favouring laggards). This criticism does not apply to homogenous sectors where 'convergence' method is used (thus favouring leaders).
Metrics	Technology exposure metrics based on data availability (do not yet take all aspects into account).	GHGs metrics. By production in most scenarios (e.g. iron and steel, tons of cement) and $ value-add (e.g. chemicals and petrochemicals). Market share.
		Pro: A common unit allows for a system of equivalence between sectors, creating comparability between activities and production in different units.
		Pro: Easier to gather emissions data, both in terms of intensity and targets. However, with a few exceptions, companies are not disclosing their emission targets in a framework that can easily be translated into an alignment metric to the 2ds pathway.
	Con: Low level of reporting, sometimes justified by the 'strategic' nature of the data needed to perform such analysis. Assumptions needed to develop the production profile forecasts of companies.	**Con**: Annual GHG emissions reduction may hide longer trends as efficiency gain may hit an eventual glass ceiling, in a context where long-term decarbonisation require a shift to zero carbon technologies. This problem is compounded by the fact that targets reported by companies are often on the short term (2020) – and often extrapolated to longer period of time.
	Pro: Forward looking exposures from industry-specific databases take into account not only investees' exposures today but their expected change over the near term.	

Source: Kepler Cheuvreux, 2°Investing Initiative, Sectoral Decarbonization Approach

Best used to assess the alignment, not to fix the misalignment

A key question is whether such a top-down approach/target, which by definition is highly prescriptive technology-wise, can drive investment allocation and is compliant with investors' fiduciary duty.

In practice, should investors be required to invest in highly risky EVs, Solar, CCS and other emerging technologies to the detriment of their fiduciary duties diligence? This question illustrates why the 2˚ benchmark is best used as a guidance and analytical framework rather than to build a portfolio, in our view. Indeed, we see a vast number of ways for an investor to comply with the macro 2° pathway, allowing for an almost infinite combination of options.

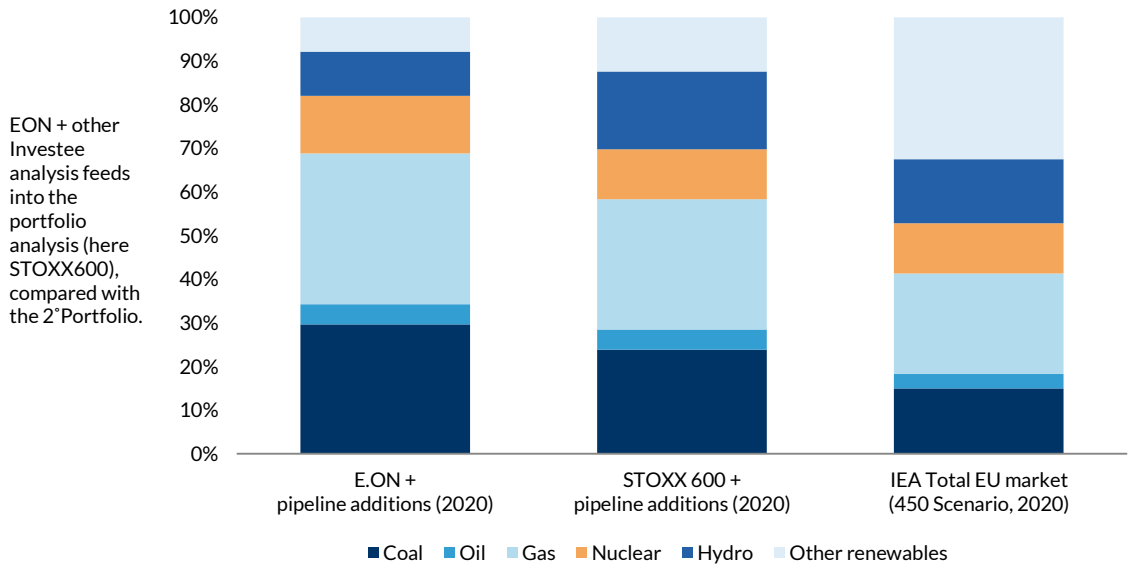
For this reason, the 2˚ benchmark can only serve as a guidance and analytical framework but can hardly be used to build a portfolio, in our view

2˚ Investing Initiative is offering a free portfolio alignment check to interested investors and index providers, in partnership with data providers. Kepler Cheuvreux will investigate what these targets mean at stock level and what the implications are for companies. Stay tuned.

How does it fit with green-brown metrics?

No systematic method exists to connect any definition of 'green' or 'brown' with a scenario shown to facilitate a feasible transition to the low-carbon economy – but the 2° Benchmark builds upon 'green-brown' metrics. The 2˚ benchmark builds on data at the asset or investee level that is used as a proxy for their future 'green' share.

Chart 33: The link between green-brown metrics at the asset and portfolio level with the 2˚Benchmark



Source: 2˚ Investing Initiative based on IEA, WEO 2014 and Global Data

EURONEXT

Expert track: Using the 2˚ Benchmark: The Euronext Low-Carbon Index

The Low Carbon 100 Europe Index, initially launched in 2008, has developed an innovative approach ahead of COP21, supported by an expert committee. The first step is to use Carbone 4 methodology to identify sectors that are important to consider when addressing the issue of climate change and transition to a low-carbon economy; it includes upstream and downstream Scope 3 for relevant categories and sectors and also 'avoided emissions', i.e. 'emissions savings' where relevant, based on sector-specific methodologies. The allocation ratio between high-carbon and low-carbon pure players is based on the alignment with a 2° trajectory which comes with a green pure player's inclusion process to improve the index exposure to low-carbon transition players as well as to the climate target pathway alignment. Non-carbon intensive players are selected based on their CDP performance and disclosure scores.

A proxy for risk?

The misalignment with a 2˚ trajectory can be thought of as a proxy for the probability of risk, as it is based on a potential scenario for the future macro-environment

Beyond measuring the contribution to the energy and climate transition, the misalignment with a 2˚ trajectory can be thought of as a proxy for the probability of risk, as it is based on a potential scenario of the future macro environment.

- One should remember, however, that these benchmarks are based on one vision of the world, which may not be what happens in reality. Indeed, there is significant uncertainty around the exact decarbonisation trajectory of the global economy and the associated technologies driving this trajectory, coupled with high uncertainty over climate policies. Note that work is underway to incorporate additional scenarios in the 2° Benchmark to deal with differences in investors' perceptions of the future.
- An assessment of climate roadmaps suggests the distribution of risks may be skewed and involve 'fat tails' and 'black swans'. These are not necessarily captured in standard valuation models and risk assessment frameworks.
- In addition, this type of analysis gives the degree of exposure to risk rather than the magnitude of the actual risk. For example, imagine a portfolio that is overexposed to conventional automobiles (vs. hybrid or electric) by 50% and to coal by 10%. The actual risk may come from coal rather than the auto sector, in absolute terms.
- This type of benchmark is primarily useful to evaluate exposure to carbon risk, but not to climate risk, i.e. extreme weather events.

Methodologies developed either adopt a 'trajectory' approach (based on a 2˚ benchmark) or other point-in-time testing

Mercer recently performed a top-down analysis of how the strategic asset allocation of a long-term investor can be affected by different climate scenarios and pathways (link) across asset classes and sectors-subsectors and different scenarios.

- The original analysis looks at four scenarios, from 'Transformation' ("More ambitious climate change mitigation action that puts us on a path to limiting global warming to 2˚C above pre-industrial era temperatures this century, with fossil fuels representing half of the mix at 2050) to 'Fragmentation' ("Limited climate action and lack of coordination result in warming rising to

4˚C or above from pre-industrial era temperatures this century", with fossil fuels representing 85% of the energy mix at 2050).

- The analysis includes both carbon and climate risks (the exact typology is technology, resource availability, impact and policy) which, depending on the scenario, will play out in different ways, and sometimes in different directions, leading to a different distribution of players and losers. Mercer, in collaboration with Marsh, is launching a new risk assessment service ("Real assets, Real Investment Risks"), which looks in more detail at the real estate, infrastructure and natural resources sectors' vulnerability to physical risks.

A recent study by the University of Cambridge Institute on Sustainability Leadership (CISL) (link) modelled three scenarios on different portfolio structures and finds that the value of equity portfolio could decrease by up to 45% as a consequence of short-term changes in climate change sentiment. Interestingly, "in a worst-case no mitigation scenario, 53% of the negative impacts of climate change across industry sectors can be hedged through industrial sector diversification and investment in industries that exhibit few climate-related risks".

Top-down approaches that assess risk at portfolio level have yet to be linked and integrated with bottom-up analysis at the asset and investee level. This field of research is likely to be active in the coming months, in particular promoted by a project commissioned by the European Commission and led by a consortium of organisations including 2˚Investing Initiative and Kepler Cheuvreux.

In addition, most risk assessment approaches focus on one type of risk – in particular carbon risk (due to regulations and technological changes). The Mercer approach is one of the few that integrates both climate-related, physical and carbon risk. The FTSE's green-brown classification also has one category for adaptation, as well as the CBI taxonomy, although rather in its infancy. This leads to the question of adaptation. The IIGCC stressed the importance of incorporating the issue of 'adaptation' in its latest report (link) and more work is needed on this.

The next step is to integrate both top-down and bottom-up approaches to risk assessment, together with measures of climate-friendliness in order to be able to answer the question: how do I invest for a world at 2˚ while protecting myself from a world at 4˚?

Data providers: reality check

While investors could directly do the research themselves, implementation costs are likely to be higher than implementation by ESG data providers given the lack of economies of scale. We argue that each has strengths and weaknesses, and that the choice depends on what you are trying to achieve and what you think is more important.

If you only have five minutes

A booming market…

We are witnessing a boom in the market of data providers, with new actors such as Bloomberg, ET Index, and Grizzly entering the scene. Providers traditionally focused on quantitative carbon metrics are diversifying to providing green-brown metrics and more contextual information, while providers that have historically been offering scoring methodologies are developing specific carbon footprinting services.

… in constant evolution

Broadly speaking, providers can be distinguished based on accessibility/costs and level of sophistication/breath of services. With increased competition and standardisation, costs are likely to decrease for 'classic' metrics (i.e. Scope 1 and 2 portfolio carbon footprint). For example, Bloomberg offers this service at no extra cost and CDP is developing a free methodology together with experts from the Carnegie Mellon University.

Differentiating factors

In this context, while methodologies often differ, we argue that this will not be the main differentiating factor going forward, but that rather the breadth of services (i.e. additional metrics such as green-brown or risk analysis), coverage in terms of stocks and asset classes, and 'insights'/'interpretation' of the results will be. We witness the development of innovative methodologies that seek to capture dynamic versus static elements, to include additional asset classes, that involve more consultative and/or web-based delivery mechanism. We also stress the importance of incorporating Scope 3 emissions in the analysis and the ability to offer uncertainty analysis.

Overview of providers

We provide an overview of data providers' services in the next section but note that providers are constantly innovating in this space and methodologies can change/developed quickly.

- Coverage varies from 600 to 50,000 investees, but in practice most providers are able to model any company using their proprietary methodology.
- All providers cover listed equity and fixed income to a certain extent. A few are developing methods for other asset classes (private equity, infrastructure, real estate, sovereign bonds, and derivatives).

- Approximately half of the data providers interviewed have Scope 3 data. A few have developed estimation methodologies for Scope 3 upstream and downstream.
- Methodologies vary, depending on whether the investee's activities are mapped to one or multiple sectors, the granularity of the estimation model, and disclosure-based versus industry or life-cycle analysis-based estimates.
- Only three providers, at this stage, are able to offer uncertainty metrics as part of the main deliverable. Others may be able to offer this on demand.
- Time-series are available as far as 2004. Most data providers have data starting from 2009-13.

Confront theory with practice: the IIGCC workshops

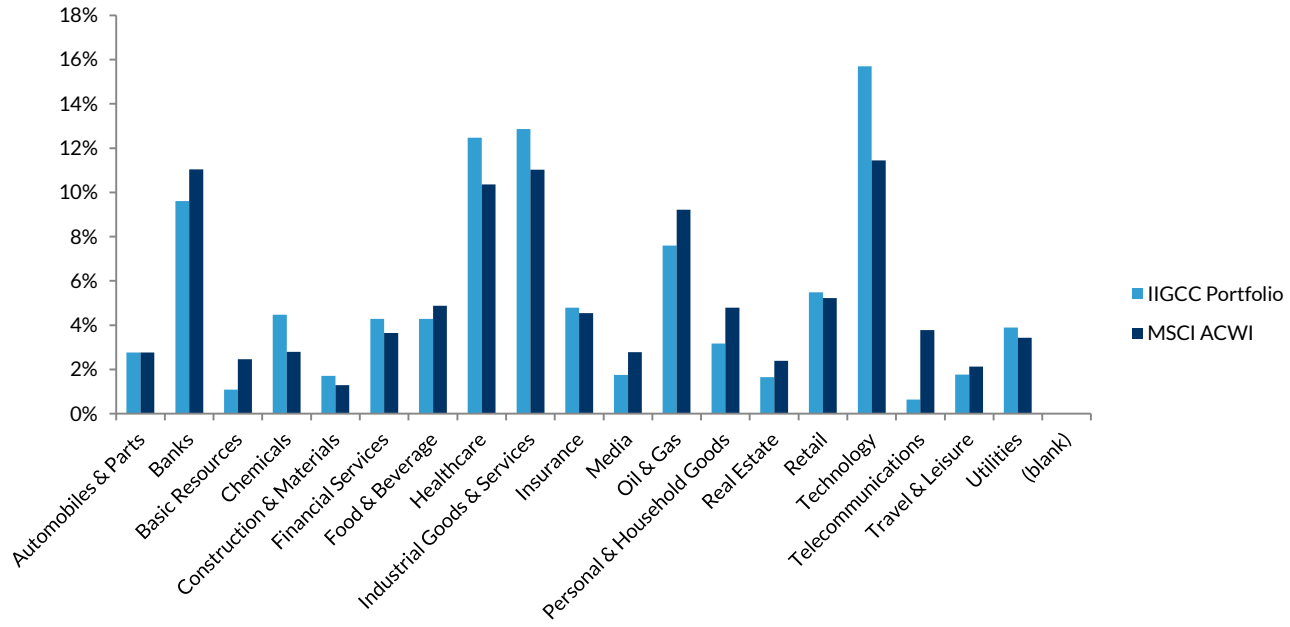
We review the results of a series of workshops organised by the Institutional Investor Group on Climate Change (IIGCC) during 2015 and show that the results on the Scope 1 and 2 carbon footprints are not fundamentally different from one data provider to the other. The results also demonstrate the importance of including Scope 3 and having an understanding of uncertainty levels due to large variability in the results when value chain emissions are included.

A series of carbon footprinting workshops on sample portfolios, organised by the Institutional Investor Group on Climate Change (IIGCC) in 2015 demonstrate that, using the same overarching framework, results from the included data providers differ marginally for Scope 1 and 2. Differences are larger when including Scope 3 emissions.

The setting - The IIGCC asked three, then four data providers (MSCI, South Pole Group, Trucost and Inrate) to calculate the footprint of a global equity portfolio (100 stocks, representative of a diversified portfolio), benchmarked against MSCI ACWI. Each data provider was asked to answer the following questions in a series of workshops:

- How do you measure carbon footprint/ intensity?
- Is the portfolio more or less carbon-intensive than the benchmark?
- How do you explain the differences?
- What is your view on the choice of metrics; Scope 3 product-in-use emissions; measurements versus estimates; performance attribution; and application to other asset classes.

Chart 34: IIGCC and MSCI AWCI portfolio sector's allocation



Source: IIGCC

Results - When comparing total Scope 1 + 2 results, the IIGCC portfolio is 12-24% more carbon-intensive than the benchmark, calculated using the metrics 'total carbon emissions' and 'carbon intensity per USDm invested'. When comparing the results in terms of 'carbon intensity per USDm sales', the IIGCC portfolio is 29-40% more carbon-intensive. Finally, the IIGCC portfolio also has a higher 'weighted average carbon intensity' (14-85%).

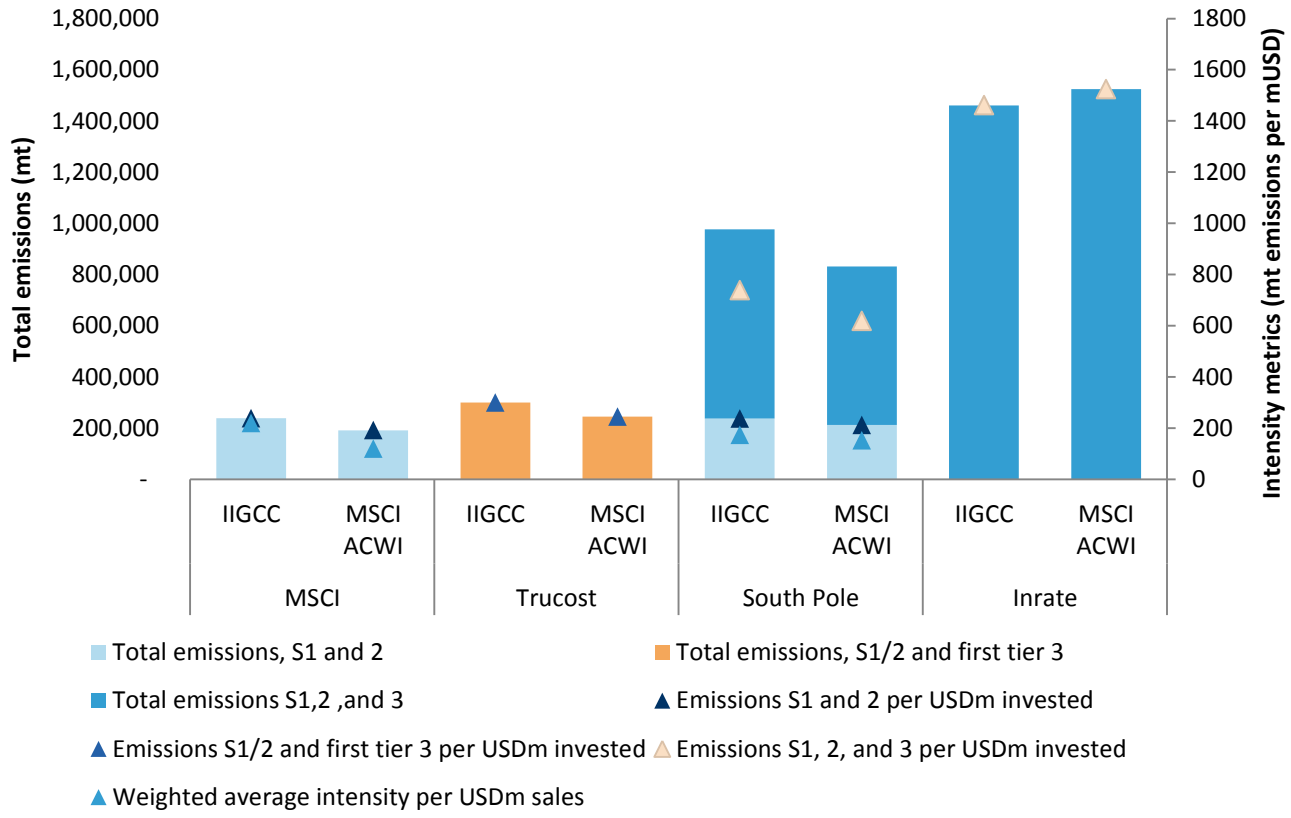
- The largest share of the difference is attributable to the estimation methodologies. Note that a majority of companies disclose in both the IIGCC and benchmark portfolios (60%+).
- It is unclear why the difference is largest when using the metric 'weighted average carbon intensity'. The carbon intensity per sales of companies with the largest overweight (but not the largest share of ownership) may be estimated, with differences between providers. This theory could not be tested on the actual results, but could explain the large difference in results.
- This also illustrates that, when using ownership-based metrics (total carbon footprint, carbon intensity/USD invested, carbon intensity/USD sales), data disclosure and quality is important for companies in carbon-intensive sectors AND in which the portfolio has a large share of ownership. When using the weighted average carbon intensity, data disclosure and quality matters for companies in carbon-intensive sectors AND overweighed in the portfolio.

Beyond these differences, the overall direction of the results is the same regardless of the methodology/data provider. When adding Scope 3, differences become more dramatic and results sometimes contradictory:

- There is a large difference in the overall results (approximately 100% compared to c. 10% when comparing Scope 1+2 results), illustrating a lower rate of disclosure and higher uncertainty levels.

- One data provider finds that the IIGCC portfolio is 4% less carbon intensive than the benchmark, while another finds that it is 19% more carbon intensive. This shows that the uncertainty level can be so high that the results may be contradictory.
- One data provider finds that when normalised by USD invested, the IIGCC portfolio is 4% less carbon intensive than the benchmark, but when normalised by USD sales, it becomes more carbon intensive (13%). This illustrates the need to use multiple metrics to understand the differences.

Chart 35: Summary of the main results



Source: Kepler Cheuvreux, based on IIGCC

While it is difficult to compare the results at sector level due to the different sector classifications and ranking metrics used by each provider, the differences are larger between results on Scope 1 and 2 only, and on Scopes 1, 2 and 3. This is apparent at stock level. When including Scope 3, the composition of the top ten contributing companies changes, with stocks in basic resources and automobiles making it to the top ten.

There is also much greater variability – i.e. different companies are listed in the top ten depending on the provider, apart from a few exceptions. When taking only Scope 1 and 2 into account, the results vary less. Interestingly, RWE is at the top of the list (in first or second position) regardless of whether Scope 1 and 2 only or Scopes 1, 2

and 3 are included, probably due to its high carbon emissions and large percentage of ownership of the portfolio in the company (28%).

The remainder of the discussions revolved around additional analysis and metrics – to assess company strategy on climate change, to incorporate proven reserves and locked-in carbon emissions, to expand the analysis to other asset classes and to quantify the positive contribution of 'green bonds'.

Bloomberg

{XLTP XPCF <GO>}

Coverage

Includes Scope 1 and 2 on 11,000 companies.
No upstream or downstream Scope 3 data (but available through the terminal)
No data on avoided emissions.
Covers listed equities but is expanding to other asset classes, such as fixed income.

Methodology

Data pyramid: GHGs disclosed, carbon disclosed, estimated based on previous disclosures, estimated based on averages. Means that there can be partial disclosure on carbon (vs. GHGs).
No methodology to avoid double-counting between Scope 1 and 2.
Estimation method: average based on intensity at GICS level 1,2 3 (choice left to the user) - not sector-specific
One-to-one company-sector mapping
No regionalisation of data estimates

Data quality procedure

No uncertainty analysis, no backtesting

Trends and benchmarks

Time-series data available since 2010
No forward-looking data/benchmark available

Availability of other data

Other data available through Bloomberg, but cannot be aggregated as part of the tool.

Accessibility

No additional costs with a Bloomberg license
Data available at the click of a button in a spreadsheet format

Three things we particularly like

Other environmental and ESG data available; no additional cost and accessible at the click of a button.

Useful to know

No scope 3 emissions in the model but available on the terminal; only equity covered (but looking to expand to other asset classes); and no uncertainty analysis; no regionalisation for estimated data; no data on avoided emissions; no forward-looking benchmark available.

Carbone 4

http://www.carbone4.com

Coverage

Includes Scope 1 and 2 for 600 companies.
Upstream and downstream Scope 3 for relevant categories and sectors (300 companies).
Includes 'avoided emissions' where relevant, based on sector-specific methodologies.
Listed issuing companies (equity and fixed income). To be extended to other assets, most probably sovereign bonds and infrastructure portfolios.

Methodology

Methodology to avoid double-counting
Estimation model based on LCA for high stakes sectors and industry averages when operational data or reported emissions not available for Scope 1, 2 and upstream Scope 3, and LCA data for downstream Scope 3.
One-to-many mapping - eleven proprietary sectors (40 sub-sectors)
Regionalisation of estimated data on demand.

Data quality procedure

Consistency check of disclosure against averages.
Qualitative uncertainty assessment (limits of the analysis in terms of methodology, perimeter and data availability are indicated in a qualitative comment).
Backtesting of estimates versus disclosures.

Trends and benchmarks

Available for one year (based on 2014 reports).
No forward-looking benchmark available (qualitative assessment).

Availability of other data

All "physical" activity data useful for the analysis of Scope 1+2+3 emissions is collected (turnover per type of product line), kWh produced/transmitted/supplied, tons of products by category, etc.). The objective is not to sell a database detailing those data.
Key results: Induced emissions and emissions savings, Carbon impact ratio, Qualitative rating (alignment of strategy, R&D expenditures and CAPEX with climate transition), Transparency of disclosure rating, Global rating.
No other environmental data.

Accessibility

Available beginning of 2016: Excel spreadsheet with CIA results by company + one key facts sheet per company + aggregation of results at portfolio level upon request. Available mid-2016: Online tool including all of the above.

Three things we particularly like

Scope 3 data available where relevant for all companies covered; LCA-based data where possible; forward-looking scoring methodology.

Useful to know

Lower coverage in terms of number of stocks and asset classes (to be extended in the future); available for one year only; no other ESG data available; no forward-looking benchmark available (but qualitative scoring on this aspect available).

ET Index

http://etindex.com/

Coverage

Includes Scope 1, 2 and 3 (upstream and downstream) on 5,000 companies, with possibility to model 1,000s.
Emission reduction from the purchase of renewable energy. This is counted to calculate a net Scope 2 figure. No other avoided emissions data available.
Listed equity, fixed income, sovereign bonds.

Methodology

No methodology to avoid double-counting between scope 1 and 2.
Estimate method based on the ET Inference algorithm. Default approach is to infer the highest reported emissions intensity figure from any company within the same sector. ET Index gives clients the choice between: sector average, sector average plus one standard deviation, sector maximum, sector maximum plus one standard deviation – not sector-specific.
One-to-one company-sector mapping to SASB - 10 Sectors, 35 sub-sectors and 89 industries.
Regionalisation for Scope 2 data estimates on demand.

Data quality procedure

Three-step internal checking process and internal analysis for outliers as well as contacting companies to validate data; independent ET Quality Assurance Panel to validate changes to methodology over time.
Uncertainty analysis and backtesting available on demand.

Trends and benchmarks

Time-series data available for five years.
No forward-looking data/benchmark available.
Possible to benchmark against the ET index series.

Availability of other data

No other data collected so far.

Accessibility

Delivery mechanisms through spreadsheet and online tool.

Three things we particularly like

Scope 3 data available for all companies covered; flexibility in estimation method (user's choice); quantitative uncertainty assessment.

Useful to know

No other carbon, environmental or ESG metrics available; no regionalisation for estimated data; no data on avoided emissions; no forward-looking benchmark available.

Grizzly

www.grizzly-ri.com

Coverage

Includes Scope 1 and 2 on 10,000 companies.
No upstream or downstream data on Scope 3 data - apart from Scope 3 'Product-in-use' for car manufacturers.
No data on avoided emissions.
Listed issuing companies (equity).

Methodology

No methodology to avoid double-counting.
Estimation method: based on an interpolation model, using disclosure as an input - not sector-specific.
One-to-one company-sector mapping to SIC (NAICS) level 4 - 983 sectors
Regionalisation for Scope 2 data estimates.

Data quality procedure

Uncertainty analysis (based on analysis of variance) and backtesting of estimated data against disclosure.
Data quality checks through outliers. Disclosure rejected if misleading magnitude.

Trends and benchmarks

Time-series data available since 2009.
No forward-looking data/benchmark available.
Emission forecasts available for N+1 and N+2 based on average trend.

Availability of other data

Other data can be available on demand.

Accessibility

Delivery mechanisms through spreadsheet.

Three things we particularly like

Quantitative uncertainty assessment; regionalisation of Scope 2 emissions when estimated; time-series data available and forecasted N+1 and N+2.

Useful to know

No scope 3 emissions (apart for downstream automobiles manufacturers); no data on other asset classes; no other environmental or ESG data available; no data on avoided emissions; no forward-looking benchmark available.

Inrate

www.inrate.com

Coverage

Includes Scope 1, 2, and 3 (both upstream and downstream) for 2,800 companies.
No data on avoided emissions.
Cover equity and bonds for the Swiss SPI (160 listed titles), MSCI Developed Markets and MSCI Emerging Markets plus we have an additional 160 non-listed corporates with listed bonds.

Methodology

Methodology to avoid double-counting based on intersector dependency data.
Environmentally-extended input-output modelling for Scope 1, 2, 3 upstream and life-cycle analysis data for Scope 3 downstream (splitting company turnover into standard product categories with specific carbon intensities). Reported data are used to calibrate the calculation model. For specific sectors like utilities, Inrate uses special overlays to calculate GHG emissions.
One-to-many company-sector mapping - 330 proprietary sectors.
No regionalisation for estimated data.

Data quality procedure

Systematic backtesting.
No uncertainty data available.

Trends and benchmarks

Time series available since 2011.
No forward-looking benchmark available.

Availability of other data

Production data available for specific sectors.
No green-brown metrics per se but proprietary ESG rating, ESG data, including controversy reporting.

Accessibility

Delivery typically in electronic form.

Three things we particularly like

Scope 3 data available for all companies covered; other environmental and ESG data available; reported data are used to calibrate the calculation model.

Useful to know

No regionalisation for estimated data; no data on avoided emissions; no forward-looking benchmark available; no uncertainty data available (but backtesting is systematically performed).

MSCI

https://www.msci.com/carbon-solutions

Coverage

Includes scope 1 and 2 for 8,500 companies.
Scope 3 upstream and downstream available when reported only (approx. 1,300 companies) - as a single figure (i.e. not split between individual Scope 3 categories).
No data on avoided emissions.
Listed companies (equity and fixed income).

Methodology

No methodology to avoid double-counting.
Estimation model: average based on disclosures, at the GICS sub-industry level. For power generation utilities, the fuel mix is used to estimate the emissions.
One-to-one company-sector mapping to GICS - 156 sectors.
No regionalisation for estimated data.

Data quality procedure

Provides confidence level based on coefficient of variance.
Data quality checks through peer review, industry leads review (data reviewed by senior analysts covering Utilities, Energy and Materials), engagement, year-on-year change verification, comparison with industry averages.

Trends and benchmarks

Time-series data available for five years.
No forward-looking benchmark available.
Benchmark can be the MSCI low-carbon index and MSCI ex fossil fuels index.

Availability of other data

Production metrics available on demand for electric utilities.
Green-brown metrics such as fossil Fuel Reserves (potential emissions), % revenues generated in Alternative energy/ Energy efficiency/ Sustainable water/ Green building/ Pollution prevention.
Scoring on Carbon Emissions, Carbon risk management, Carbon risk exposure.
Other environmental indicators such as water, toxic gases, waste etc. for selected industries as part of the corporate ratings.

Accessibility

Direct access to database, or production of Carbon Portfolio Analytics report.

Three things we particularly like

Scope 3 data available (when reported only); quantitative uncertainty assessment; and other environmental and ESG data available.

Useful to know

No data on other asset classes (beyond equity and fixed income); no data on avoided emissions; no regionalisation for estimated data; no forward-looking benchmark available; no data on avoided emissions.

South Pole Group

http://www.thesouthpolegroup.com/sectors/financial-industry

Coverage

Includes scope 1, 2, and 3 (upstream and product-use downstream, other downstream categories on demand) for 50,000 companies.
Avoided emissions data, using bottom-up approaches, on-demand.
Listed issuing companies (fixed income and equity), Real Estate, Private Equity, Sovereign Bonds, unlisted fixed income issuers, Infrastructure, Forestry, Agriculture, Green Bonds, direct assets.

Methodology

Methodology to avoid double counting based on sector dependency data and life-cycle analysis principles.
Estimation based on bottom-up sector-based modelling for Scope 1 and 2, environmentally extended input-output (EEIO) modelling for Scope 3 upstream and life-cycle analysis data for Scope 3 downstream.
One-to-one company-sector mapping to proprietary classification system (800 sectors).
Regionalisation on demand.

Data quality procedure

Collected from all available sources, validated and corrected (25% disregarded).
All reported data point receives a "trust" value based on a range of parameters. All approximated data point receives a model quality rating.

Trends and benchmarks

Time-series data available since 2005 on demand, 2010 on the shelf.
Forward-looking benchmark available

Availability of other data

Forward-looking analysis on trends, Climate Scoring for company trend analysis on cross-sectorial and sector-specific parameters.
Reserve analysis, Carbon Underground 200 ™ Screenings, Power production analysis, sector deep-dives.
Production and green-brown metrics available for a range of industries with 'homogenous' product portfolio
Scoring across industries as well as industry specific and aggregated - in partnership with OEKOM.
Other environmental indicators (water, biodiversity, forestry/deforestation).

Accessibility

1) Online (yourSRI.com, bloomberg tool APPS CARBON, Cleancapitalist.com) with up/ download functions; 2) Via spreadsheet, data report (overview), full climate impact report, studies and case studies, capacity building and training workshops, direct data feed via API and as 360 climate change consultant; 3) Through partnerships (Ethifinance, CAER, CDP, Oekom Research, Bloomberg, Corporate Knights etc); 4) As service including labelling (Climate Transparent Investment, Climate Impact Reducing Investment, Climate Neutral Investment).

Three things we particularly like

Scope 3 data available for all companies covered, quantitative uncertainty assessment, other environmental data available and partnership with OEKOM.

Useful to know

No other ESG data available (beyond environmental data).

Sustainalytics

http://www.sustainalytics.com/carbon-solution-suite

Coverage

Includes scope 1 and 2 for 14,000 companies.
No scope 3 data available (upstream or downstream).
No data on avoided emissions.
Listed companies (equity), private companies from 2016.

Methodology

No methodology to avoid double-counting.
Sector-specific regression model based on disclosures (84, polynomial and non-linear) and other features including revenue, market capitalisation, environmental management data and total employees.
One-to-one company-sector mapping to42 peer-groups. Next step for some sectors: sub-industry level.
No regionalization for estimated data.

Data quality procedure

Estimated emissions models are tested with existing emissions (maximum tolerated average error = 20%).
Data scrubbing for reported data (consider only 50% or more confidence in the reported data). For estimations: check for outliers.

Trends and benchmarks

Time-series data available since 2009.
No forward-looking benchmark available.

Availability of other data

Green-brown metrics such as fossil Fuel Reserves (potential emissions), renewable energy and others.
Scoring on exposure and management in relation to stranded assets, assessment preparedness, etc.
Other environmental indicators available.

Accessibility

Email, FTP, online platform.

Three things we particularly like

Quantitative uncertainty assessment; other environmental data available; other ESG data available.

Useful to know

No scope 3 emissions; no other asset classes yet; no forward-looking benchmark available; no regionalisation for estimated data.

Trucost

www.trucost.com

Coverage

Includes scope 1, 2, and 3 upstream (5,600 companies, with ability to model 1,000s).
Scope 3 downstream data on demand (based on life-cycle-analysis (LCA)).
Avoided emissions data, using bottom-up approaches, on-demand.
Listed equity, fixed income, infrastructure, real estate and methodology for sovereign bonds under development.
Methodology for derivatives available for public consultation.

Methodology

No methodology to avoid double-counting between Scope 1 and 2 but can be done on demand based on electricity production data (or Scope 1 and 2) and on intersector dependency data for Scope 1,2, and 3).
Estimation model: environmentally-extended input/output (EEIO) model for Scope 1, 2 and 3. Can be refined for some sectors with production data (electricity production, minerals extracted).
One-to-many company-sector mapping to NAICS - 531 sectors.
Regionalisation on demand for Scope 2 - Chinese specific emission factors soon to be available.

Data quality procedure

No uncertainty analysis.
Data quality checks through internal checks, year-on-year changes, comparison with industry averages, engagement.

Trends and benchmarks

Time-series data available since 2004.
Forward-looking benchmark available - partnership with 2° Investing Initiative to do the 2° Portfolio Benchmark analysis.

Availability of other data

Production metrics available on demand.
Green-brown metrics such as share of renewables, revenue from green sectors.
Scoring on carbon tax exposure in development.
Other environmental indicators (waste, water, air/land/water pollution, land use) - both reported and estimated, all sectors.

Accessibility

Delivery online (e-board), spreadsheet, report, FTP.

Three things we particularly like

Upstream Scope 3 available and downstream Scope 3 data on demand for all companies covered; other environmental data available; time-series data since 2004.

Useful to know

No quantitative uncertainty analysis, no other ESG data (beyond environmental data).

Vigeo

http://www.vigeo.com/csr-rating-agency/

Coverage

Includes Scope 1 and 2 for 2,000 companies and progressively increasing.
No data on Scope 3 (upstream and downstream).
Avoided emissions are evaluated in our sector-specific risk analysis to derive an Energy Transtion Score.
Listed companies (equity and fixed income).

Methodology

No methodology to avoid double-counting.
Estimates based on the nature of company's activities and size, on a sector-basis. Two methods: a linear regression based on revenue, market cap, and employees; and a sector average calculated for revenue, market cap and employees ratios. In addition, in specific cases where it is detected that neither the sector ratios, nor the correlation are strong enough, it is backed by a direct comparison of companies with the closest peers in terms of activity and size with reported data.
One-to-many company-sector mapping to BICS - 38 sectors. Adapted for customisation purposes.
No regionalisation for estimated data.

Data quality procedure

Reporting boundaries, scopes and coherence of data are checked for disclosed emissions. Highest and lowest values on each sector are revised.
Standard deviations are calculated for all our ratios for each sector. In addition, the highest and lowest ratios for each sector are revised.
Backtesting.

Trends and benchmarks

Time-series data available since 2013 for carbon footprint, ten years for energy transition score.
No forward-looking benchmark available.

Availability of other data

Green-brown metrics are integrated in the sector-specific risk analysis to derive an Energy Transition Score.
Emissions are categorised into four grades. Sector-specific risk analysis on several criteria (policies, development, results) is used to calculate an Energy Transition Score.
The Energy Transition score covers a wide range of sector-specific risks and opportunities tied to climate change which are selected and weighted resulting in a consolidated Energy Transition Strategy score for each issuer. These specific criteria include, to name but a few, development of renewable energy, management of energy consumption and GHG emissions, management of impacts from the use and disposal of products, management of impacts from transportation, and development of green products and services among others.
Other ESG data available.

Accessibility

Delivery via Vigeo's Extranet in the sections "Deliveries" or "Data Table", as well as via e-mail.

Three things we particularly like

Quantitative uncertainty assessment; other environmental and ESG data available; Energy-Transition Score.

Useful to know

No estimates for Scope 3; no data on other asset classes (beyond public equity and fixed income); no forward-looking benchmark available; no regionalisation for estimated data.

Research ratings and important disclosures

Disclosure checklist - Potential conflict of interests

Stock	ISIN	Disclosure (See Below)	Currency	Price
A2A	IT0001233417	nothing to disclose	EUR	1.28
ABB	CH0012221716	nothing to disclose	CHF	18.96
ABOITIZ EQUITY VENT.	PHY0001Z1040	nothing to disclose	PHP	55.7
Acciona	ES0125220311	nothing to disclose	EUR	77.20
ADANI POWER	INE814H01011	nothing to disclose	INR	28.6
Air Liquide	FR0000120073	nothing to disclose	EUR	123.65
Aixtron	DE000A0WMPJ6	nothing to disclose	EUR	7.32
AkzoNobel	NL0000009132	nothing to disclose	EUR	65.40
Alerion	IT0004720733	nothing to disclose	EUR	2.52
Alstom	FR0010220475	nothing to disclose	EUR	29.41
Andritz	AT0000730007	nothing to disclose	EUR	49.19
Ansaldo STS	IT0003977540	nothing to disclose	EUR	9.80
Arcadis	NL0006237562	nothing to disclose	EUR	23.05
BASF	DE000BASF111	nothing to disclose	EUR	76.35
BHP Billiton	GB0000566504	nothing to disclose	GBP	1,825.00
Bic	FR0000120966	nothing to disclose	EUR	150.75
Blue Solutions	FR0011592104	15, 17, 19	EUR	22.50
BNP Paribas	FR0000131104	nothing to disclose	EUR	56.51
Bureau Veritas	FR0006174348	nothing to disclose	EUR	19.43
CAF	ES0121975017	nothing to disclose	EUR	256.10
CaixaBank	ES0140609019	nothing to disclose	EUR	3.48
Centrica	GB00B033F229	nothing to disclose	GBP	212.20
CHINA SHENHUA EN.'A'	CNE100000767	nothing to disclose	CNY	15.68
DANIELI	IT0000076502	nothing to disclose	EUR	18.83
E.ON	DE000ENAG999	nothing to disclose	EUR	8.89
EDP	PTEDP0AM0009	nothing to disclose	EUR	3.21
Enagas	ES0130960018	nothing to disclose	EUR	27.77
Ence	ES0130625512	nothing to disclose	EUR	3.64
ENEL	IT0003128367	nothing to disclose	EUR	4.21
ENI	IT0003132476	14, 16, 18	EUR	14.86
ERG	IT0001157020	nothing to disclose	EUR	12.10
Eurofins	FR0000038259	nothing to disclose	EUR	318.10
Falck Renewables	IT0003198790	nothing to disclose	EUR	1.10
Iberdrola	ES0144580Y14	nothing to disclose	EUR	6.55
Imtech	NL0010886891	nothing to disclose	EUR	0.03
Inditex	ES0148396007	nothing to disclose	EUR	33.35
Intertek	GB0031638363	nothing to disclose	GBP	2,646.00
IREN	IT0003027817	nothing to disclose	EUR	1.47
Jeronimo Martins	PTJMT0AE0001	nothing to disclose	EUR	13.33
Kering	FR0000121485	9	EUR	167.20
LafargeHolcim	CH0012214059	nothing to disclose	CHF	55.75
Legrand	FR0010307819	6, 14, 16, 18	EUR	53.83
Linde	DE0006483001	nothing to disclose	EUR	165.75
MICROSOFT	US5949181045	nothing to disclose	USD	52.97
Nordex	DE000A0D6554	nothing to disclose	EUR	30.57
Novozymes	DK0060336014	nothing to disclose	DKK	328.00
Oerlikon	CH0000816824	nothing to disclose	CHF	9.76
Osram Licht	DE000LED4000	nothing to disclose	EUR	38.80
Pfeiffer Vacuum Technology	DE0006916604	nothing to disclose	EUR	108.85
Philips	NL0000009538	nothing to disclose	EUR	25.15
Royal Dutch Shell Plc		nothing to disclose	GBP	2,141.00
RWE	DE0007037129	nothing to disclose	EUR	11.40
S&T	AT0000A0E9W5	8	EUR	5.05
Saeta Yield	ES0105058004	nothing to disclose	EUR	8.81
Saint-Gobain	FR0000125007	nothing to disclose	EUR	40.35
Schneider Electric	FR0000121972	nothing to disclose	EUR	57.91
SGS	CH0002497458	nothing to disclose	CHF	1,917.00
Siemens	DE0007236101	nothing to disclose	EUR	94.77
Sky	GB0001411924	nothing to disclose	GBP	1,091.00
Solvay	BE0003470755	6	EUR	103.50
Statoil	NO0010096985	nothing to disclose	NOK	132.80
Talgo	ES0105065009	15, 17, 19	EUR	5.82
Total	FR0000120271	nothing to disclose	EUR	46.46
Umicore	BE0003884047	nothing to disclose	EUR	38.94
Verbund	AT0000746409	nothing to disclose	EUR	13.61
Vossloh	DE0007667107	nothing to disclose	EUR	62.74
Wienerberger	AT0000831706	6, 9	EUR	15.61
WPP	JE00B8KF9B49	nothing to disclose	GBP	1,514.00
Zehnder Group	CH0276534614	nothing to disclose	CHF	33.55
Zumtobel	AT0000837307	nothing to disclose	EUR	19.83

Source: Factset closing prices of 17/11/2015
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Rating breakdown	A	B
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Hold	37.4%	0.0%
Reduce	16.4%	0.0%
Not Rated/Under Review/Accept Offer	0.4%	0.0%
Total	100.0%	0.0%

Source: Kepler Cheuvreux
A: % of all research recommendations
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